

## The Third Spectrum of Copper (Cu III) \*

A. G. Shenstone \*\*

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An analysis of Cu III based on observations from 500 to 6900 Å is presented. The low structures  $3d^9$  and  $3d^84s$  are complete, including the rarely, if ever before, found  $3d^8(^1S)4s^2S$ . The  $3d^74s^2$  includes  $^4F$ ,  $^2F$ ,  $^2G$ , and  $^2H$  but the  $^4P$ ,  $^2P$ ,  $a^2D$ ,  $b^2D$  have eluded all attempts to find them. The ionization potential calculated from  $4s$ ,  $5s$ ,  $6s$   $^4F_{3/2}$  is  $296\,980\text{ cm}^{-1}$  but by a comparison with Ni II which has a longer series an approximate value of  $297\,140$  can be estimated. The  $3d^84d$  group is complete, except for one level, as is  $5d$  based on  $^3F$  and  $^1G$ , the other  $5d$  groups being incomplete.  $3d^8(^3F)4f$  is complete and 26 levels based on  $^1D$ ,  $^3P$ ,  $^1G$  are known.  $3d^8(^3F)5g$  is incomplete and a few levels based on  $^1D$  and  $^1G$  have been found. A discussion of the validity of the analysis of Cu IV by J. F. Schröder and Th. A. M. Van Kleef is given.

Key words: Atomic energy levels; atomic spectrum; copper; doubly ionized copper; electron configuration; ionization potential; wavelengths.

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\*\* Present address: Department of Physics, Princeton University, Princeton, N.J. 08540

### 1. Introduction

The analysis of the third spectrum of copper (Cu III) which is described in this paper, is the result of research by a number of spectroscopists. The work up to 1951 is summarized in the paper published in that year by A. G. Shenstone and L. Wilets [1]<sup>1</sup> in which a correct description was given of the low structures and of a few higher ones. It was restricted, however, by the inadequacy of the condensed spark source which was the usual means, at that date, of exciting spectra of ionization above the second.

In 1956, Dr. W. C. Martin and I began to make a new description of the spectrum using the pulsed hollow cathode tube which had been recently introduced. The result was a new and much expanded line list which was adequate for the discovery of many new odd and even levels including  $3d^74s^2^4F$ . Along with work on other spectra, I continued to work on that description of Cu III until 1965, when I came to the conclusion that I might gain a great deal by first making a very complete analysis of the isoelectronic spectrum Ni II. A second spectrum is more easily

observed and analyzed because it can be produced with great purity and with fine lines by the hollow cathode tube discharge sometimes called a Schüler tube. An additional advantage was that the Bureau of Standards was then in a position to supply me with plates in the Schumann region taken with their 10.7 meter vacuum spectrograph. The Ni II analysis was published in 1970 [2] and I then returned to Cu III. In both Ni II and Cu III, I was greatly assisted by the kindness of Victor Kaufman of NBS who photographed the vacuum spectra on the 10.7 meter instrument using the hollow cathode, the pulsed hollow cathode, and the sliding spark. The dispersion of about .78 Å per mm. on the NBS plates much improved the accuracy of the data, in spite of the fact that the Doppler and Stark broadening of the lines reduced the resolution considerably. The six 18" plates from NBS, which I measured several times with great care, consisted of the following:

(1) 2 plates 1400 to 2100 Å with a lithium fluoride filter to eliminate second order lines. The spectra consisted of two exposures using the ordinary hollow cathode, one exposure of the pulsed hollow cathode, and three of the sliding spark with increasing pulse current.

(2) 2 plates 820 to 1520 Å. Six spectra were taken,

<sup>1</sup> Figures in brackets indicate the literature references at the end of this paper.

one being the ordinary hollow cathode and five being the pulsed hollow cathode. It was fortunate that those exposures are very good because that wavelength range includes a very large number of important transitions.

(3) 2 plates 0 to 950 Å with two hollow cathode exposures, one sliding spark and three pulsed hollow cathode exposures. The sliding spark exposure is obviously impure and the weakest pulsed hollow cathode does not extend below 850 Å. The other two are good but lack standards. Many of the strong lines are, however, calculable approximately, and almost all of them occur in second order on other plates where standards are available. Throughout the U-V spectrum, except as just mentioned, there are adequate standards of Cu II [3], C I [4], Si II [5], and Cl I [6] so that there are few regions where too long interpolations must be used. I made all measurements by eye, using a Societe Genevoise Comparator of 40 cm travel and accuracy about 2 μm. Intensity estimates were made on three exposures wherever available in order to obtain as much data as possible to distinguish Cu III and Cu IV lines. This is important because of the existence of the paper on Cu IV by Schröder and Van Kleef [7].

The spectra above 2000 Å were photographed on the Princeton 21 ft Paschen circle at about 1.3 Å per mm or, where necessary, in the first or second orders of our 21 ft Wadsworth spectrograph which uses a 15,000 line-per-inch grating.

Table 1 is the list of all lines attributed to Cu III. The total number of lines measured is about 3200 including both Cu III and Cu IV, and all were measured at least twice and many four or five times. Many small sections were remeasured wherever there was a question of close pairs or impurities.

## 2. Analysis

Table 2 is a synopsis of all the levels found. The chief structures expected in Cu III are due to the addition of an electron to  $3d^8(^3F, ^3P, ^1S, ^1D, ^1G)$ . This includes the lowest term of all,  $3d^9^2D$ .

The much improved line list required the redetermination of the levels of the principal terms of  $3d^84s$  and  $3d^84p$ . That then led to the determination of the levels of  $3d^84d$  which had previously been the stumbling block which led to my analysis of Ni II [2]. The difficulty was revealed when 31 levels were found in the group, ten based on  $3d^8^3F_4$ , twelve instead of ten apparently on  $^3F_3$  and nine on  $^3F_2$ . The extra two levels in the middle group have  $J$ -values of  $5\frac{1}{2}$  and  $4\frac{1}{2}$  and must be the two components of the term  $3d^74s^2^2H$ . They perturb the  $3d^84d$  levels quite badly. As in Ni II, the  $4d^2D$  term is several thousand wave numbers above the other levels of the configuration.

The structure  $3d^84s$  was known previously except for the predicted level  $3d^8(^1S)4s^2^2S$ . The corresponding  $^2P$  was identified when I noticed two strong lines at 542.902 Å and 553.012 Å which could hardly be anything but combinations with the two levels of  $3d^9^2D$ . This was confirmed by the discovery of the necessary satellite at 549.075 Å, completing the multiplet. It then became clear that the term involved must be

$3d^8(^1S)4p^2P$ , and knowing the approximate position of  $^2S$ , it was possible to find the combinations of  $^2S$  and  $^2P$ , thus fixing the true position of  $^2S$ . I believe this is the first spectrum in which those levels have been found with certainty.

It is pertinent to make a few remarks about the naming of levels. It is obvious that in Ni II and Cu III we are dealing with spectra in which there is no pure Russell-Saunders coupling except in  $3d^9^2D$ . However, it has meaning and is useful to use  $R-S$  nomenclature throughout the analysis for the following reasons. The argument starts with the lowest term  $3d^9^2D$  which is pure  $R-S$  coupling and the  $3d^84s^4F$  and  $^2F$  terms which are quite close to  $R-S$  coupling, the doublet being well removed from the quartet. Those levels combine with 18 levels of  $3d^8(^3F)4p$  to give a pattern of intensities that reveals the characters of the 18 levels with very little doubt. There is evidently some mixing of  $^4G_{41/2}$  and  $^4F_{41/2}$ , but there is enough evidence to distinguish them. Within the higher levels of  $3d^84s$ , there is some ambiguity between  $^2D_{21/2}$  and  $^4P_{21/2}$  but the intensities favor the choice made here. The  $4s'''^2G$  and its triad of odd terms are quite close to  $R-S$  coupling. The argument can be carried on step by step up to  $3d^85g$ .

I have carried out that system of naming by intensities throughout the spectrum, and the nomenclature used is the same as that used in "Atomic Energy Levels" except that the levels are not grouped together in terms but are arranged numerically. The right-hand superscript has been omitted from the odd levels as unnecessary except in the case of a few numbered levels. Tables 3 and 4 are the lists of the even and odd levels found in this research.

Throughout this work I was very much helped by calculations made for me at NBS by Sugar and Martin [8]. They included  $3d^8(4d \text{ \& } 5s) + 3d^74s^2$ ;  $3d^8(5d \text{ \& } 6s)$ ;  $3d^84p$ ;  $3d^85p$ ;  $3d^84f$ ;  $3d^85g$ . Their calculations made possible the discovery of a large number of levels, especially many of the levels of the prime, double-prime and triple-prime groups (Table 2) as well as the  $4f$  and  $5g$  configurations.

The  $s^2^4F$  was found some years ago from its combinations with the  $4p$  levels and by extrapolation from Co I and Ni II. The  $^2H$  was identified in the  $4d$  group and  $^2G$  and  $^2F$  were named by using the calculated predictions. It is strange that the  $s^2^4P$  has evaded all my efforts to find it, though it must be fairly close to the predicted position.

In finding the levels of configurations built on  $^3F$ , I have used a general regularity which impressed me in the analysis of Ni II. Taking as an example the group  $5p^4 \text{ \& } ^2DFG$ , the higher two  $J$ -values of each quartet are based on  $^3F_4$ , the next three quartet levels and the three doublet levels of higher  $J$  are based on  $^3F_3$ , and the remaining three quartet and three doublet levels are based on  $^3F_2$ . The same scheme is applicable to the  $4d$ ,  $5d$ , and  $4f$  levels with some modifications because  $^4S$  and  $^4P$  do not have the requisite number of components. In  $5g$  the scheme reaches an extreme which makes it possible to identify some, but not all of the levels. In fact, the number of combinations

TABLE 1. *Observed lines of Cu III*

$\lambda$ (vac)	Intensity	Wavenumber	Transition	$\lambda$ (vac)	Intensity	Wavenumber	Transition
505.722	15	197737.1		658.609	0	151835.2	89018 $9/2$ - 240852° $9/2$
514.566	10	194338.5		659.022	0	151740.0	89046 $7/2$ - 240786° $7/2$
526.684	3	189867.2	62065 $7/2$ - 251932° $5/2$	659.110	15	151719.7	60805 $9/2$ - 212525° $11/2$
526.783	4	189831.5	60805 $9/2$ - 250636° $7/2$	659.533	3	151622.4	63143 $5/2$ - 214766° $5/2$
527.387	2	189614.1	60805 $9/2$ - 250419° $7/2$	659.587	5	151610.0	60805 $9/2$ - 212415° $9/2$
528.882	2	189078.1	60805 $9/2$ - 249883° $7/2$	659.810	2	151558.8	63143 $5/2$ - 214702° $5/2$
530.915	1	188354.1	62065 $7/2$ - 250419° $7/2$	659.935	4	151530.1	63886 $3/2$ - 215417° $5/2$
535.407	3	186773.8	60805 $9/2$ - 247578° $11/2$	661.053	0	151273.8	63886 $3/2$ - 215160° $1/2$
537.785	1	185947.9	62065 $7/2$ - 248013° $7/2$ ?	661.169	8	151247.3	62065 $7/2$ - 213311° $7/2$
538.105	5	185837.3	62065 $7/2$ - 247902° $9/2$	661.312	5	151214.6	63143 $5/2$ - 214357° $3/2$
538.487	1	185705.5	60805 $9/2$ - 246510° $9/2$	661.445	5	151184.1	63143 $5/2$ - 214328° $7/2$
539.382	1	185397.4	60805 $9/2$ - 246202° $7/2$	661.681	0	151130.2	77968 $5/2$ - 229098° $7/2$
540.513	0	185009.4	63886 $3/2$ - 248896° $3/2$	662.180	20	151016.3	60805 $9/2$ - 211821° $7/2$
540.930	25	184866.8	60805 $9/2$ - 245671° $7/2$	662.424	10	150960.7	62065 $7/2$ - 213025° $5/2$
541.185	0	184779.7		662.556	0	150930.6	62065 $7/2$ - 212995° $9/2$
541.345	0	184725.1		663.213	1	150781.1	80552 $5/2$ - 231333° $5/2$
542.312	1	184395.7	63886 $3/2$ - 248281° $5/2$	664.651	5	150454.9	77968 $5/2$ - 228423° $5/2$
542.378	20	184373.3	62065 $7/2$ - 249077° $9/2$	665.114	2	150350.2	62065 $7/2$ - 212415° $9/2$
542.493	40	184334.2	60805 $9/2$ - 245139° $11/2$	665.868	1	150179.9	78780 $3/2$ - 228960° $5/2$
542.902	75	184195.3	0 $5/2$ - 184197° $3/2$	666.116	3	150124.0	89018 $9/2$ - 239142° $11/2$
547.324	3	182707.1		667.819	4	149741.2	89046 $7/2$ - 238788° $9/2$
547.833	1	182537.4	62065 $7/2$ - 244602° $5/2$	672.668	50	148661.7	0 $5/2$ - 148663° $5/2$
548.159	2	182428.8	60805 $9/2$ - 243234° $7/2$	675.312	0	148079.7	78780 $3/2$ - 226857° $5/2$ ?
549.075	4	182124.5	2071 $3/2$ - 184197° $3/2$	675.753	3	147983.1	67016 $7/2$ - 215000° $7/2$
549.669	1	181927.7		675.884	10	147954.4	77968 $5/2$ - 225923° $7/2$
549.987	4	181822.5		676.566	75	147805.2	0 $5/2$ - 147806° $7/2$
553.012	50	180827.9	2071 $3/2$ - 182900° $1/2$	677.115	2	147685.4	67016 $7/2$ - 214702° $5/2$
556.231	15	179781.4		677.502	3	147601.0	68963 $5/2$ - 216565° $5/2$
559.279	30	178801.6	60805 $9/2$ - 239606° $9/2$	677.640	3	147571.0	67016 $7/2$ - 214588° $9/2$
559.836	3	178623.7		678.578	1	147367.0	85447 $3/2$ - 232814° $3/2$
560.155	3	178522.0		679.401	3	147188.5	80305 $3/2$ - 227494° $3/2$
569.648	2	175547.0		679.940	3	147071.8	80423 $1/2$ - 227494° $3/2$
570.683	3	175228.6		680.022	5	147054.1	68963 $5/2$ - 216017° $7/2$
582.657	1	171627.6	60805 $9/2$ - 232435° $7/2$	682.166	125	146591.9	2071 $3/2$ - 148663° $5/2$
589.328	15	169684.8		682.357	20	146550.8	80305 $3/2$ - 226857° $5/2$
595.662	1	167880.4		685.024	1	145980.3	67016 $7/2$ - 212995° $9/2$ ?
598.680	2	167034.1	62065 $7/2$ - 229098° $7/2$	686.128	5	145745.4	2071 $3/2$ - 147817° $3/2$
601.433	3	166269.6	67016 $7/2$ - 233285° $5/2$	686.902	50	145581.2	2071 $3/2$ - 147653° $1/2$
602.507	50	165973.2	67016 $7/2$ - 232989° $5/2$	687.763	2	145398.9	67016 $7/2$ - 212415° $9/2$
603.549	50	165686.6	68963 $5/2$ - 234650° $3/2$	687.896	5	145370.8	80552 $5/2$ - 225923° $7/2$
604.441	3	165442.1	67016 $7/2$ - 232458° $5/2$	687.981	150	145352.8	0 $5/2$ - 145353° $3/2$
605.516	3	165148.4		690.249	40	144875.3	0 $5/2$ - 144876° $3/2$
605.625	150	165118.7	60805 $9/2$ - 225923° $7/2$	691.549	50	144602.9	2071 $3/2$ - 146675° $1/2$
605.792	2	165073.2	63886 $3/2$ - 228960° $5/2$	693.510	40	144194.0	0 $5/2$ - 144195° $5/2$
606.131	100	164980.8		697.926	20	143281.7	2071 $3/2$ - 145353° $3/2$
606.821	125	164793.2	62065 $7/2$ - 226857° $5/2$	700.186	40	142819.2	0 $5/2$ - 142820° $7/2$
608.453	40	164351.2	63143 $5/2$ - 227494° $3/2$	700.261	50	142803.9	2071 $3/2$ - 144876° $3/2$
609.468	10	164077.5	63886 $3/2$ - 227964° $1/2$	701.688	20	142513.5	0 $5/2$ - 142513° $3/2$
609.661	10	164025.6	68963 $5/2$ - 232989° $5/2$	702.118	25	142426.2	0 $5/2$ - 142427° $5/2$
611.543	50	163520.8		703.612	30	142123.8	2071 $3/2$ - 144195° $5/2$
612.282	3	163323.4		711.853	15	140478.4	2071 $3/2$ - 142550° $1/2$
613.728	5	162938.6		712.043	20	140441.0	2071 $3/2$ - 142513° $3/2$
614.129	20	162832.2		712.481	35	140354.6	2071 $3/2$ - 142427° $5/2$
615.246	3	162536.6		713.264	30	140200.5	0 $5/2$ - 140201° $3/2$
615.670	200	162424.7	60805 $9/2$ - 223229° $11/2$	715.532	150	139756.2	0 $5/2$ - 139757° $5/2$
616.031	150	162329.5	60805 $9/2$ - 223134° $9/2$	719.489	75	138987.5	0 $5/2$ - 138989° $3/2$
616.971	1	162082.2	67016 $7/2$ - 229098° $7/2$	719.520	75	138981.5	0 $5/2$ - 138982° $7/2$
617.349	125	161982.9	62065 $7/2$ - 224048° $9/2$	723.961	35	138129.0	2071 $3/2$ - 140201° $3/2$
619.174	100	161505.5	62065 $7/2$ - 223570° $7/2$	724.197	50	138084.0	0 $5/2$ - 138084° $5/2$
619.674	5	161375.2		726.296	30	137684.9	2071 $3/2$ - 139757° $5/2$
619.775	50	161348.9	63886 $3/2$ - 225235° $3/2$	728.920	10	137189.3	2071 $3/2$ - 139261° $1/2$
619.936	75	161307.0	63143 $5/2$ - 224450° $7/2$	730.375	125	136916.0	2071 $3/2$ - 138989° $3/2$
620.230	30	161230.5		732.029	100	136606.6	0 $5/2$ - 136607° $5/2$
620.850	20	161069.5	62065 $7/2$ - 223134° $9/2$	732.693	25	136482.8	0 $5/2$ - 136483° $3/2$
622.806	4	160563.6	63886 $3/2$ - 224450° $5/2$	735.229	100	136012.0	2071 $3/2$ - 138084° $5/2$
623.337	5	160426.9	63143 $5/2$ - 223570° $7/2$	743.298	100	134535.5	2071 $3/2$ - 136607° $5/2$
651.000	30	153609.8	0 $5/2$ - 153609° $7/2$	743.986	35	134411.1	2071 $3/2$ - 136483° $3/2$
653.871	1	152935.4	62065 $7/2$ - 215000° $7/2$	777.119	150	128680.4	0 $5/2$ - 128679° $5/2$
655.638	2	152523.2	62065 $7/2$ - 214588° $9/2$	778.599	75	128435.8	0 $5/2$ - 128435° $3/2$
657.074	10	152189.9	60805 $9/2$ - 212995° $9/2$	788.071	250	126892.1	0 $5/2$ - 126892° $5/2$
658.342	3	151896.7	63886 $3/2$ - 215782° $3/2$	788.460	250	126829.5	0 $5/2$ - 126829° $7/2$
				789.837	100	126608.4	2071 $3/2$ - 128679° $5/2$

TABLE 1. Observed lines of Cu III—Continued

$\lambda$ (vac)	Inten- sity	Wavenumber	Transition	$\lambda$ (vac)	Inten- sity	Wavenumber	Transition
791.365	250	126363.9	2071 $\frac{3}{2}$ — 128435° $\frac{3}{2}$	1042.934	10	95883.34	118864° $\frac{7}{2}$ — 214747 $\frac{9}{2}$
793.055	100	126094.7	0 $\frac{5}{2}$ — 126094° $\frac{7}{2}$	1048.880	40	95339.8	
795.261	15	125744.9	0 $\frac{5}{2}$ — 125744° $\frac{3}{2}$	1052.287	1	95031.1	126829° $\frac{7}{2}$ — 221861 $\frac{7}{2}$
797.559	75	125382.6	0 $\frac{5}{2}$ — 125382° $\frac{5}{2}$	1058.542	1	94469.6	126094° $\frac{7}{2}$ — 220563 $\frac{9}{2}$
801.145	150	124821.3	2071 $\frac{3}{2}$ — 126892° $\frac{5}{2}$	1060.815	10	94267.1	120577° $\frac{5}{2}$ — 214844 $\frac{7}{2}$
802.840	100	124557.8	0 $\frac{5}{2}$ — 124557° $\frac{7}{2}$	1062.854	3	94086.3	118864° $\frac{7}{2}$ — 212951 $\frac{5}{2}$
808.579	40	123673.8	2071 $\frac{3}{2}$ — 125744° $\frac{3}{2}$	1072.974	4	93198.9	128679° $\frac{5}{2}$ — 221878 $\frac{5}{2}$
810.105	10	123440.8	0 $\frac{5}{2}$ — 123440° $\frac{5}{2}$	1073.822	10	93125.3	121864° $\frac{3}{2}$ — 214989° $\frac{5}{2}$
810.959	20	123310.8	2071 $\frac{3}{2}$ — 125382° $\frac{5}{2}$	1078.350	1	92734.3	120577° $\frac{5}{2}$ — 213312 $\frac{3}{2}$
816.297	12	122504.4	0 $\frac{5}{2}$ — 122504° $\frac{7}{2}$	1080.380	5	92560.0	122637° $\frac{1}{2}$ — 215197 $\frac{3}{2}$
820.591	0	121863.4	0 $\frac{5}{2}$ — 121864° $\frac{3}{2}$	1080.513	2	92548.6	120577° $\frac{5}{2}$ — 213127 $\frac{3}{2}$
829.345	100	120577.1	0 $\frac{5}{2}$ — 120577° $\frac{5}{2}$	1081.679	5	92448.9	118864° $\frac{7}{2}$ — 211313 $\frac{9}{2}$
829.429	10	120564.9	2071 $\frac{3}{2}$ — 122637° $\frac{1}{2}$	1082.569	1	92372.9	120577° $\frac{5}{2}$ — 212951 $\frac{5}{2}$
830.394	3	120424.8	118864° $\frac{7}{2}$ — 239290 $\frac{9}{2}$	1083.732	20	92273.7	
833.654	5	119953.8	118864° $\frac{7}{2}$ — 238818 $\frac{5}{2}$	1089.246	1	91806.6	
834.262	3	119866.4	118864° $\frac{7}{2}$ — 238730 $\frac{7}{2}$	1095.742	1	91262.4	121864° $\frac{3}{2}$ — 213127 $\frac{3}{2}$
834.782	15	119791.8	2071 $\frac{3}{2}$ — 121864° $\frac{3}{2}$	1097.134	1	91146.6	
836.632	0	119526.9	121864° $\frac{3}{2}$ — 241391 $\frac{3}{2}$	1098.775	1	91010.4	118864° $\frac{7}{2}$ — 209875 $\frac{5}{2}$
836.922	1	119485.4	120577° $\frac{5}{2}$ — 240062 $\frac{5}{2}$	1107.574	1	90287.4	124557° $\frac{7}{2}$ — 214844 $\frac{7}{2}$
837.415	4	119415.1	118864° $\frac{7}{2}$ — 238280 $\frac{9}{2}$	1132.874	3	88271.1	126829° $\frac{7}{2}$ — 215100 $\frac{5}{2}$
840.269	1	119009.5	146534° $\frac{9}{2}$ — 265544 $\frac{11}{2}$	1142.133	3	87555.5	128679° $\frac{5}{2}$ — 216235 $\frac{3}{2}$
841.300	4	118863.7	0 $\frac{5}{2}$ — 118864° $\frac{7}{2}$	1147.815	1	87122.1	124557° $\frac{7}{2}$ — 211679 $\frac{5}{2}$
842.113	0	118748.9	120577° $\frac{5}{2}$ — 239326 $\frac{3}{2}$	1149.405	1	87001.5	60805 $\frac{9}{2}$ — 147806° $\frac{7}{2}$
842.828	3	118648.2	123440° $\frac{5}{2}$ — 242088 $\frac{7}{2}$	1154.825	5	86593.2	67016 $\frac{7}{2}$ — 153609° $\frac{7}{2}$
843.414	1	118565.7	123440° $\frac{5}{2}$ — 242006 $\frac{5}{2}$	1157.149	20	86419.3	138084° $\frac{5}{2}$ — 224503 $\frac{3}{2}$
843.843	12	118505.5	2071 $\frac{3}{2}$ — 120577° $\frac{5}{2}$	1158.697	1	86303.8	126829° $\frac{7}{2}$ — 213133 $\frac{5}{2}$
844.106	5	118468.5	122504° $\frac{7}{2}$ — 240972 $\frac{9}{2}$	1161.993	2	86059.0	126892° $\frac{5}{2}$ — 212951 $\frac{5}{2}$
844.160	1	118461.0	121864° $\frac{3}{2}$ — 240325 $\frac{5}{2}$	1165.037	2	85834.2	
847.022	0	118060.7	120577° $\frac{5}{2}$ — 238638 $\frac{7}{2}$	1166.295	5	85741.6	
847.801	4	117952.2	121337° $\frac{9}{2}$ — 239290 $\frac{9}{2}$	1166.954	3	85693.2	62065 $\frac{7}{2}$ — 147806° $\frac{7}{2}$
847.874	2	117942.1	147647° $\frac{11}{2}$ — 265589 $\frac{13}{2}$	1169.022	1	85541.6	
848.740	2	117821.7	122504° $\frac{7}{2}$ — 240325 $\frac{5}{2}$	1169.312	0	85520.4	125744° $\frac{3}{2}$ — 211286 $\frac{1}{2}$
849.081	10	117774.4	121337° $\frac{9}{2}$ — 239112 $\frac{11}{2}$	1169.376	5	85515.7	63143 $\frac{5}{2}$ — 148663° $\frac{3}{2}$
850.760	2	117542.0	121699° $\frac{11}{2}$ — 239240 $\frac{11}{2}$	1174.588	20	85136.2	138989° $\frac{3}{2}$ — 224503 $\frac{3}{2}$
851.530	2	117435.7		1177.311	4	84939.3	128679° $\frac{5}{2}$ — 213815 $\frac{7}{2}$
852.508	3	117301.0	121337° $\frac{9}{2}$ — 238638 $\frac{7}{2}$	1178.554	3	84849.7	
852.548	20	117295.4	121699° $\frac{11}{2}$ — 238994 $\frac{13}{2}$	1179.186	25	84804.3	126829° $\frac{7}{2}$ — 211679 $\frac{5}{2}$
855.124	1	116942.1	121337° $\frac{9}{2}$ — 238280 $\frac{9}{2}$	1179.270	3	84798.2	138982° $\frac{7}{2}$ — 223787 $\frac{5}{2}$
856.360	3	116773.3	124442° $\frac{9}{2}$ — 241215 $\frac{9}{2}$	1179.807	4	84759.6	138989° $\frac{3}{2}$ — 223787 $\frac{5}{2}$
856.846	2	116707.1	125382° $\frac{5}{2}$ — 242088 $\frac{7}{2}$	1180.559	2	84705.6	126892° $\frac{5}{2}$ — 211652 $\frac{3}{2}$
857.767	20	116581.8	121699° $\frac{11}{2}$ — 238280 $\frac{9}{2}$	1181.391	1	84705.6	128435° $\frac{3}{2}$ — 213141 $\frac{1}{2}$
858.036	3	116545.2	125744° $\frac{3}{2}$ — 242290 $\frac{5}{2}$	1182.887	15	84646.0	68963 $\frac{5}{2}$ — 153609° $\frac{7}{2}$
858.241	15	116517.4	124442° $\frac{9}{2}$ — 240960 $\frac{11}{2}$	1183.606	3	84538.9	169608 $\frac{3}{2}$ — 254147° $\frac{3}{2}$
858.995	2	116415.1	124557° $\frac{7}{2}$ — 240972 $\frac{9}{2}$	1183.747	20	84477.5	
860.554	4	116204.2	126094° $\frac{7}{2}$ — 242297 $\frac{9}{2}$	1184.635	3	84414.2	166159 $\frac{9}{2}$ — 250636° $\frac{7}{2}$
861.934	3	116018.2	123550° $\frac{9}{2}$ — 239568 $\frac{9}{2}$	1185.638	2	84342.8	125744° $\frac{3}{2}$ — 210159 $\frac{5}{2}$
863.105	5	115860.8	124442° $\frac{9}{2}$ — 240303 $\frac{7}{2}$	1186.223	2	84301.2	
863.798	0	115767.8	124557° $\frac{7}{2}$ — 240325 $\frac{5}{2}$	1186.405	1	84288.2	140201° $\frac{3}{2}$ — 224503 $\frac{3}{2}$ ?
864.008	1	115739.7	123550° $\frac{9}{2}$ — 239290 $\frac{9}{2}$	1186.801	50	84260.1	125744° $\frac{3}{2}$ — 210033 $\frac{3}{2}$
864.378	12	115690.1	123550° $\frac{9}{2}$ — 239240 $\frac{11}{2}$	1187.006	15	84245.6	166159 $\frac{9}{2}$ — 250419° $\frac{7}{2}$
864.768	1	115638.0	138982° $\frac{7}{2}$ — 254620 $\frac{5}{2}$	1187.393	3	84218.1	168856 $\frac{5}{2}$ — 253102° $\frac{3}{2}$
865.047	2	115600.7	126094° $\frac{7}{2}$ — 241693 $\frac{5}{2}$	1187.746	40	84193.1	138982° $\frac{7}{2}$ — 223200 $\frac{9}{2}$
868.646	1	115121.7	126094° $\frac{7}{2}$ — 241215 $\frac{9}{2}$	1188.981	20	84105.6	167739 $\frac{7}{2}$ — 251932° $\frac{3}{2}$
868.804	1	115100.8	128679° $\frac{5}{2}$ — 243780 $\frac{5}{2}$	1190.054	25	84029.8	169608 $\frac{3}{2}$ — 253713° $\frac{1}{2}$
868.898	2	115088.3	123550° $\frac{9}{2}$ — 238638 $\frac{7}{2}$	1196.385	1	83585.1	139757° $\frac{5}{2}$ — 223787 $\frac{5}{2}$
869.478	1	115011.5	124557° $\frac{7}{2}$ — 239568 $\frac{9}{2}$	1196.450	18	83580.6	140201° $\frac{3}{2}$ — 223787 $\frac{5}{2}$
870.451	1	114883.0	124557° $\frac{7}{2}$ — 239440 $\frac{7}{2}$	1197.235	1	83525.8	168856 $\frac{5}{2}$ — 252437° $\frac{5}{2}$
871.611	10	114730.1	123550° $\frac{9}{2}$ — 238280 $\frac{9}{2}$	1197.535	10	83504.9	
874.230	1	114386.4	126829° $\frac{7}{2}$ — 241215 $\frac{9}{2}$	1197.685	8	83494.4	
876.569	2	114081.1	124557° $\frac{7}{2}$ — 238638 $\frac{7}{2}$	1199.793	35	83347.7	169608 $\frac{3}{2}$ — 253102° $\frac{3}{2}$
877.729	3	113930.4	128679° $\frac{5}{2}$ — 242610 $\frac{7}{2}$	1200.374	1	83307.4	126892° $\frac{5}{2}$ — 210239 $\frac{7}{2}$
881.260	2	113473.9	126829° $\frac{7}{2}$ — 240303 $\frac{7}{2}$	1200.449	1	83302.2	
884.845	3	113014.1	128679° $\frac{5}{2}$ — 241693 $\frac{5}{2}$	1200.956	50	83267.0	126892° $\frac{5}{2}$ — 210159 $\frac{5}{2}$
894.888	2	111745.8	126892° $\frac{5}{2}$ — 238638 $\frac{7}{2}$	1201.287	10	83244.1	128435° $\frac{3}{2}$ — 211679 $\frac{5}{2}$
941.369	1	106228.3	77968 $\frac{5}{2}$ — 184197° $\frac{3}{2}$	1203.472	3	83092.9	
960.431	3	104119.9	78780 $\frac{3}{2}$ — 182900° $\frac{1}{2}$	1203.725	25	83075.5	168856 $\frac{5}{2}$ — 251932° $\frac{5}{2}$
964.789	5	103649.6		1203.782	3	83071.5	
1012.608	1	98754.9		1204.791	5	83001.9	
1012.665	2	98749.3	85447 $\frac{3}{2}$ — 184197° $\frac{3}{2}$	1205.067	20	82982.9	126892° $\frac{5}{2}$ — 209875 $\frac{5}{2}$
1033.419	5	96766.2	86133 $\frac{1}{2}$ — 182900° $\frac{1}{2}$	1206.014	10	82917.8	166159 $\frac{9}{2}$ — 249077° $\frac{9}{2}$



TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (vac)	Intensity	Wavenumber	Transition	$\lambda$ (vac)	Intensity	Wavenumber	Transition
1206.303	20	82897.9	167739 $^{7/2}$ – 250636 $^{7/2}$	1244.841	18	80331.5	
1206.996	10	82850.3	128435 $^{3/2}$ – 211286 $^{1/2}$	1245.204	15	80308.1	144195 $^{5/2}$ – 224503 $^{3/2}$
1207.300	5	82829.5	169608 $^{3/2}$ – 252437 $^{5/2}$	1245.643	5h	80279.8	166159 $^{9/2}$ – 246439 $^{9/2}$
1212.073	2	82503.3		1245.724	30	80274.6	167739 $^{7/2}$ – 248013 $^{7/2}$
1212.342	4	82485.0	138084 $^{5/2}$ – 220569 $^{7/2}$	1247.113	12	80185.2	167739 $^{7/2}$ – 247924 $^{9/2}$
1212.941	3	82444.2	128679 $^{3/2}$ – 211123 $^{3/2}$	1247.463	10	80162.7	167739 $^{7/2}$ – 247902 $^{9/2}$
1213.163	5	82429.2	167739 $^{7/2}$ – 250168 $^{7/2}$	1248.198	3	80115.5	
1214.005	15	82372.0		1249.108	15	80057.1	
1214.173	1	82360.6		1249.322	5h	80043.4	166159 $^{9/2}$ – 246202 $^{7/2}$
1214.323	1	82350.4	118864 $^{7/2}$ – 201215 $^{5/2}$	1249.376	20	80040.0	168856 $^{5/2}$ – 248896 $^{3/2}$
1214.709	2	82324.2	169608 $^{3/2}$ – 251932 $^{5/2}$	1250.429	15	79972.6	
1216.176	5	82224.9		1251.681	20	79892.6	136483 $^{3/2}$ – 216376 $^{5/2}$
1216.395	12	82210.1	63143 $^{5/2}$ – 145353 $^{3/2}$	1252.073	1	79867.5	121864 $^{3/2}$ – 201732 $^{3/2}$
1216.532	2	82200.9	166159 $^{9/2}$ – 248360 $^{9/2}$	1252.783	1	79822.3	118864 $^{7/2}$ – 198687 $^{9/2}$
1217.361	5	82144.9		1252.884	50	79815.8	
1217.580	50	82130.1	62065 $^{7/2}$ – 144195 $^{5/2}$	1253.261	20	79791.8	137041 $^{1/2}$ – 216833 $^{1/2}$
1217.703	2	82121.8	139757 $^{5/2}$ – 221878 $^{5/2}$	1253.631	30	79768.3	136607 $^{5/2}$ – 216376 $^{5/2}$
1218.371	5	82076.8	142427 $^{5/2}$ – 224503 $^{3/2}$	1253.984	25	79745.8	169608 $^{3/2}$ – 249353 $^{5/2}$
1219.299	300	82014.3	60805 $^{9/2}$ – 142820 $^{7/2}$	1254.136	25	79736.2	167739 $^{7/2}$ – 247475 $^{7/2}$
1219.511	4	82000.1		1254.711	100	79699.6	68963 $^{5/2}$ – 148663 $^{5/2}$
1219.725	30	81985.7		1254.777	20	79695.4	
1220.493	5	81934.1		1254.875	12	79689.2	
1221.678	5	81854.6	166159 $^{9/2}$ – 248013 $^{7/2}$	1255.082	15	79676.1	63143 $^{5/2}$ – 142820 $^{7/2}$
1221.742	10	81850.3		1255.314	35	79661.3	136483 $^{3/2}$ – 216145 $^{5/2}$
1222.796	30	81779.8	168856 $^{5/2}$ – 250636 $^{7/2}$	1255.848	35	79627.5	136607 $^{5/2}$ – 216235 $^{3/2}$
1223.019	3	81764.9	166159 $^{9/2}$ – 247924 $^{9/2}$				144876 $^{3/2}$ – 224503 $^{3/2}$
1223.217	25	81751.6		1256.409	20	79591.9	144195 $^{5/2}$ – 223787 $^{5/2}$
1223.347	75	81743.0	166159 $^{9/2}$ – 247902 $^{9/2}$	1256.822	20	79565.8	
1223.507	10	81732.3	63143 $^{5/2}$ – 144876 $^{3/2}$	1257.273	50	79537.2	136607 $^{5/2}$ – 216145 $^{5/2}$
1223.639	40	81723.4	128435 $^{3/2}$ – 210159 $^{5/2}$	1257.672	75	79512.0	166159 $^{9/2}$ – 245671 $^{7/2}$
1223.959	25	81702.1		1259.052	50	79424.8	168856 $^{5/2}$ – 248281 $^{5/2}$
1224.253	35	81682.5	167739 $^{7/2}$ – 249421 $^{5/2}$	1259.503	12	79396.4	
1224.784	25	81647.0	67016 $^{7/2}$ – 148663 $^{5/2}$	1259.576	8	79391.8	
1224.870	3	81641.3		1259.934	150	79369.2	63143 $^{5/2}$ – 142513 $^{3/2}$
1225.269	1	81614.7	167739 $^{7/2}$ – 249353 $^{5/2}$				136607 $^{5/2}$ – 215976 $^{7/2}$
1225.526	20	81597.6	128435 $^{3/2}$ – 210033 $^{3/2}$	1260.226	15	79350.8	121864 $^{3/2}$ – 201215 $^{5/2}$
1225.778	20	81580.8	138982 $^{7/2}$ – 220563 $^{9/2}$	1260.658	15	79323.7	136483 $^{3/2}$ – 215807 $^{3/2}$
1226.091	10	81560.0	128679 $^{5/2}$ – 210239 $^{7/2}$	1261.204	30	79289.3	169608 $^{3/2}$ – 248896 $^{3/2}$
1227.830	15	81444.5	169608 $^{3/2}$ – 251052 $^{5/2}$	1261.301	60	79283.2	63143 $^{5/2}$ – 142427 $^{5/2}$
1228.210	150	81419.3	166159 $^{9/2}$ – 247578 $^{11/2}$	1261.388	40	79277.7	136483 $^{3/2}$ – 215761 $^{1/2}$
1229.108	3	81359.8	142427 $^{5/2}$ – 223787 $^{5/2}$	1261.616	2	79263.4	
1229.439	50	81337.9	167739 $^{7/2}$ – 249077 $^{9/2}$	1261.928	3	79243.8	
1229.771	3	81316.0	166159 $^{9/2}$ – 247475 $^{7/2}$	1262.637	40	79199.3	136607 $^{5/2}$ – 215807 $^{3/2}$
1229.847	25	81310.9	168856 $^{5/2}$ – 250168 $^{7/2}$	1262.725	2	79193.8	137041 $^{1/2}$ – 216235 $^{3/2}$
1230.412	1	81273.6	142513 $^{3/2}$ – 223787 $^{5/2}$	1264.305	1	79094.8	122637 $^{1/2}$ – 201732 $^{3/2}$
1232.469	1	81137.9		1265.164	10	79041.1	142820 $^{7/2}$ – 221861 $^{7/2}$
1233.309	3	81082.7		1266.134	40	78980.6	166159 $^{9/2}$ – 245139 $^{11/2}$
1233.788	30	81051.2	63143 $^{5/2}$ – 144195 $^{5/2}$	1266.380	15	78965.2	
1234.932	1	80976.1		1267.252	10	78910.9	144876 $^{3/2}$ – 223787 $^{5/2}$
1235.071	20	80967.0	142820 $^{7/2}$ – 223787 $^{5/2}$	1267.855	15	78873.4	
1235.326	30	80950.3		1268.346	4	78842.8	68963 $^{5/2}$ – 147806 $^{7/2}$
1235.643	15	80929.5		1269.254	4	78786.4	
1236.131	50	80897.6		1269.587	60	78765.8	137041 $^{1/2}$ – 215807 $^{3/2}$
1236.260	1	80889.1		1270.181	8	78728.9	118864 $^{7/2}$ – 197593 $^{7/2}$
1236.776	5	80855.4		1270.327	20	78719.9	137041 $^{1/2}$ – 215761 $^{1/2}$
1237.204	50	80827.4		1270.484	2	78710.2	
1237.441	1	80811.9	139757 $^{5/2}$ – 220569 $^{7/2}$	1270.646	20	78700.1	167739 $^{7/2}$ – 246439 $^{9/2}$
1237.745	20	80792.1		1271.071	8	78673.8	169608 $^{3/2}$ – 248281 $^{5/2}$
1237.780	50	80789.8	67016 $^{7/2}$ – 147806 $^{7/2}$	1271.231	100	78663.9	63886 $^{3/2}$ – 142550 $^{1/2}$
1237.905	10	80781.6		1271.826	75	78627.1	63886 $^{3/2}$ – 142513 $^{3/2}$
1238.323 <sup>a</sup>	60	80754.4	62065 $^{7/2}$ – 142820 $^{7/2}$	1271.988	40	78617.1	136483 $^{3/2}$ – 215100 $^{5/2}$
1239.927	8	80649.9		1272.449	2	78588.6	136607 $^{5/2}$ – 215197 $^{3/2}$ ?
1240.126	6	80637.0	120577 $^{5/2}$ – 201215 $^{5/2}$	1272.710	8	78572.5	
1240.216	15	80631.1		1273.129	30	78546.6	
1240.363	40	80621.6	167739 $^{7/2}$ – 248360 $^{9/2}$	1273.231	15	78540.3	63886 $^{3/2}$ – 142427 $^{5/2}$
1241.244	30	80564.3	168856 $^{5/2}$ – 249421 $^{5/2}$	1273.703	35	78511.2	118864 $^{7/2}$ – 197375 $^{9/2}$
1241.574	5	80542.9	167739 $^{7/2}$ – 248281 $^{5/2}$	1273.790	10	78505.9	136483 $^{3/2}$ – 214989 $^{5/2}$
1242.282	20	80497.0	168856 $^{5/2}$ – 249353 $^{5/2}$	1273.904	2	78498.8	
1242.439	2	80486.8		1274.007	25	78492.5	136607 $^{5/2}$ – 215100 $^{5/2}$
1243.016	1	80449.5		1274.476	15	78463.6	167739 $^{7/2}$ – 246202 $^{7/2}$
1244.082	2	80380.6	142820 $^{7/2}$ – 223200 $^{9/2}$	1274.969	30	78433.3	145353 $^{3/2}$ – 223787 $^{5/2}$
1244.378	200	80361.4	62065 $^{7/2}$ – 142427 $^{5/2}$	1275.808	5	78381.7	136607 $^{5/2}$ – 214989 $^{5/2}$
1244.538	75	80351.1	166159 $^{9/2}$ – 246510 $^{9/2}$				

TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (vac)	Intensity	Wavenumber	Transition	$\lambda$ (vac)	Intensity	Wavenumber	Transition
1276.280	20	78352.7	120577° <sub>5/2</sub> — 198930 <sub>7/2</sub>	1312.391	200	76196.8	118864° <sub>7/2</sub> — 195061 <sub>9/2</sub>
1276.691	5	78327.5		1312.630	5	76182.9	122504° <sub>7/2</sub> — 198687 <sub>9/2</sub>
1277.081	30	78303.6		1312.867	30	76169.2	121864° <sub>3/2</sub> — 198033 <sub>1/2</sub>
1278.928	12	78190.5	118864° <sub>7/2</sub> — 197055 <sub>7/2</sub>	1312.950	30	76164.4	120577° <sub>5/2</sub> — 196742 <sub>7/2</sub>
1279.142	100	78177.4	60805 <sub>9/2</sub> — 138982° <sub>7/2</sub>	1313.295	75	76144.4	136607° <sub>5/2</sub> — 212752 <sub>7/2</sub>
1279.422	8	78160.3		1313.697	50	76121.1	121864° <sub>3/2</sub> — 197985 <sub>3/2</sub>
1281.064	18	78060.1	138084° <sub>5/2</sub> — 216145 <sub>5/2</sub>	1314.062	50	76099.9	137041° <sub>1/2</sub> — 213141 <sub>1/2</sub>
1281.617	3	78026.4		1314.933	25	76049.5	139757° <sub>5/2</sub> — 215807 <sub>3/2</sub>
1283.744	2	77897.1		1315.208	5	76033.6	140201° <sub>3/2</sub> — 216235 <sub>3/2</sub>
1283.829	2	77892.0	138084° <sub>5/2</sub> — 215976 <sub>7/2</sub>	1315.455	40	76019.3	62065 <sub>7/2</sub> — 138084° <sub>5/2</sub>
1284.259	18	77865.9	118864° <sub>7/2</sub> — 196730 <sub>5/2</sub>	1316.131	100	75980.3	147806° <sub>7/2</sub> — 223787 <sub>5/2</sub>
1284.877	35	77828.5	146675° <sub>1/2</sub> — 224503 <sub>3/2</sub>	1317.312	20	75912.2	68963 <sub>5/2</sub> — 144876° <sub>3/2</sub>
1285.677	15	77780.0		1318.483	20	75844.7	63143 <sub>5/2</sub> — 138989° <sub>3/2</sub>
1286.276	8	77743.8	142820° <sub>7/2</sub> — 220563 <sub>9/2</sub>	1318.574	60	75839.5	148663° <sub>5/2</sub> — 224503 <sub>3/2</sub>
1286.631	12	77722.4	138084° <sub>5/2</sub> — 215807° <sub>3/2</sub>	1318.689	30	75832.9	125382° <sub>5/2</sub> — 201215 <sub>3/2</sub>
1287.139	50	77691.7	62065 <sub>7/2</sub> — 139757° <sub>5/2</sub> ?	1319.204	25	75803.3	67016 <sub>7/2</sub> — 142820° <sub>7/2</sub>
1287.256	12	77684.6		1319.870	15	75765.0	138982° <sub>7/2</sub> — 214747 <sub>9/2</sub>
1289.123	2	77572.1	139261° <sub>1/2</sub> — 216833 <sub>1/2</sub>	1320.208	4	75745.6	168856° <sub>5/2</sub> — 244602° <sub>5/2</sub>
1289.647	3	77540.6		1320.469	40	75730.7	138084° <sub>5/2</sub> — 213815 <sub>7/2</sub>
1290.598	35	77483.5	120577° <sub>5/2</sub> — 198061 <sub>5/2</sub>	1320.513	50	75728.1	
1291.504	2	77429.1		1320.697	25	75717.6	121337° <sub>9/2</sub> — 197055 <sub>7/2</sub>
1291.773	3	77413.0		1320.985	10	75701.1	121337° <sub>9/2</sub> — 197038 <sub>11/2</sub>
1291.860	10	77407.8	120577° <sub>5/2</sub> — 197985 <sub>3/2</sub>	1321.859	2	75651.0	
1292.011	12	77398.7		1322.655	30	75605.5	140201° <sub>3/2</sub> — 215807 <sub>3/2</sub>
1292.201	10	77387.3	138989° <sub>3/2</sub> — 216376 <sub>5/2</sub>	1323.456	20	75559.7	140201° <sub>3/2</sub> — 215761 <sub>1/2</sub>
1293.286	2	77322.4	120577° <sub>5/2</sub> — 197900 <sub>5/2</sub>	1323.501	20	75557.2	122504° <sub>7/2</sub> — 198061 <sub>5/2</sub>
1295.206	15	77207.8	136607° <sub>5/2</sub> — 213815 <sub>7/2</sub>	1323.575	40	75553.0	147647° <sub>11/2</sub> — 223200 <sub>9/2</sub>
1295.701	60	77178.3	67016 <sub>7/2</sub> — 144195° <sub>5/2</sub>	1324.025	50	75527.3	147647° <sub>11/2</sub> — 223175 <sub>11/2</sub>
1295.852	2	77169.3		1324.108	25	75522.5	120577° <sub>5/2</sub> — 196100 <sub>3/2</sub>
1295.944	30	77163.8	118864° <sub>7/2</sub> — 196028 <sub>9/2</sub>	1324.502	3	75500.1	
1296.075	20	77156.0	138989° <sub>3/2</sub> — 216145 <sub>5/2</sub>	1324.594	5	75494.8	167739 <sub>7/2</sub> — 243234° <sub>7/2</sub>
1297.438	30	77075.0	166159 <sub>9/2</sub> — 243234° <sub>7/2</sub>	1324.685	35	75489.6	123440° <sub>5/2</sub> — 198930 <sub>7/2</sub>
1297.580	5	77066.5		1325.042	40	75469.3	139261° <sub>1/2</sub> — 214730 <sub>1/2</sub>
1297.729	10	77057.7	63143 <sub>5/2</sub> — 140201° <sub>3/2</sub>	1325.241	20	75458.0	121337° <sub>9/2</sub> — 196795 <sub>9/2</sub>
1297.809	2	77052.9		1325.521	40	75442.0	147647° <sub>11/2</sub> — 223089 <sub>7/2</sub>
1298.433	40	77015.9	120577° <sub>5/2</sub> — 197593 <sub>7/2</sub>	1325.734	20	75429.9	138084° <sub>5/2</sub> — 213514 <sub>3/2</sub>
1298.653	3	77002.9	144876° <sub>3/2</sub> — 221878 <sub>5/2</sub>	1326.080	10	75410.2	67016 <sub>7/2</sub> — 142427° <sub>5/2</sub>
1299.216	20	76969.5		1326.174	15	75404.9	121337° <sub>9/2</sub> — 196742 <sub>7/2</sub>
1299.807	20	76934.5	136483° <sub>3/2</sub> — 213418 <sub>1/2</sub>	1326.314	15	75396.9	122504° <sub>7/2</sub> — 197900 <sub>5/2</sub> ?
1299.987	30	76923.8	118864° <sub>7/2</sub> — 195788 <sub>7/2</sub>	1326.362	75	75394.2	147806° <sub>7/2</sub> — 223200 <sub>9/2</sub>
1300.093	15	76917.6	62065 <sub>7/2</sub> — 138982° <sub>7/2</sub>	1326.453	8	75389.0	
1300.272	1	76907.0	136607° <sub>5/2</sub> — 213514 <sub>3/2</sub>	1326.828	15	75367.7	147806° <sub>5/2</sub> — 223174 <sub>7/2</sub>
1301.005	15	76863.7	167739 <sub>7/2</sub> — 244602° <sub>5/2</sub>	1327.171	150	75348.2	122637° <sub>1/2</sub> — 197985 <sub>3/2</sub>
1301.235	15	76850.1	147653° <sub>7/2</sub> — 224503 <sub>3/2</sub>	1327.265	20	75342.9	139757° <sub>5/2</sub> — 215100 <sub>3/2</sub>
1301.603	2	76828.3	136483° <sub>3/2</sub> — 213312 <sub>1/2</sub>	1327.399	75	75335.3	121864° <sub>3/2</sub> — 197199 <sub>1/2</sub>
1301.699	15	76822.7	120577° <sub>5/2</sub> — 197400 <sub>5/2</sub>	1327.551	8	75326.7	146534° <sub>9/2</sub> — 221861 <sub>7/2</sub>
1301.779	2	76818.0	138989° <sub>3/2</sub> — 215807 <sub>3/2</sub>	1328.316	50	75283.3	147806° <sub>7/2</sub> — 223089 <sub>7/2</sub>
1302.547	35	76772.7	138989° <sub>3/2</sub> — 215761 <sub>1/2</sub>	1328.854	25	75252.8	118864° <sub>7/2</sub> — 194117 <sub>7/2</sub>
1303.708	12	76704.3	136607° <sub>5/2</sub> — 213312 <sub>3/2</sub>	1329.230	25	75231.5	68963 <sub>5/2</sub> — 144195° <sub>5/2</sub>
1303.945	5	76690.3	118864° <sub>7/2</sub> — 195555 <sub>5/2</sub>	1329.861	60	75195.8	136483° <sub>3/2</sub> — 211679 <sub>5/2</sub>
1304.362	35	76665.8	146534° <sub>9/2</sub> — 223200 <sub>9/2</sub>	1330.352	75	75168.1	136483° <sub>3/2</sub> — 211652 <sub>3/2</sub>
1304.504	35	76657.5	124557° <sub>7/2</sub> — 201215 <sub>5/2</sub>	1331.147	15	75123.2	148663° <sub>5/2</sub> — 223787 <sub>5/2</sub>
1304.572	50	76653.5	118864° <sub>7/2</sub> — 195518 <sub>9/2</sub>	1331.187	20	75120.9	126094° <sub>7/2</sub> — 201215 <sub>5/2</sub>
1304.634	40	76649.8	136483° <sub>3/2</sub> — 213133 <sub>5/2</sub>	1331.741	50	75089.7	122504° <sub>7/2</sub> — 197593 <sub>7/2</sub>
1304.743	30	76643.4	136483° <sub>3/2</sub> — 213127 <sub>3/2</sub>	1332.062	75	75071.6	136607° <sub>5/2</sub> — 211679 <sub>5/2</sub>
1304.804	40	76639.9	146534° <sub>9/2</sub> — 223174 <sub>7/2</sub>	1332.469	5	75048.6	138084° <sub>5/2</sub> — 213133 <sub>3/2</sub>
1304.944	12	76631.6	140201° <sub>3/2</sub> — 216833 <sub>1/2</sub>	1332.554	40	75043.9	136607° <sub>5/2</sub> — 211652 <sub>3/2</sub>
1305.161	40	76618.9	139757° <sub>5/2</sub> — 216376 <sub>5/2</sub>	1332.971	300	75020.4	118864° <sub>7/2</sub> — 193885 <sub>5/2</sub>
1306.246	100	76555.3	146534° <sub>9/2</sub> — 223089 <sub>9/2</sub>	1333.280	3	75003.0	139261° <sub>1/2</sub> — 214264 <sub>3/2</sub>
1306.409	20	76545.7	139261° <sub>1/2</sub> — 215807 <sub>3/2</sub>	1333.735	60	74977.4	120577° <sub>5/2</sub> — 195555 <sub>5/2</sub>
1306.750	10	76525.7	136607° <sub>5/2</sub> — 213133 <sub>5/2</sub>	1334.367	150	74941.9	121864° <sub>3/2</sub> — 196806 <sub>3/2</sub>
1306.864	12	76519.1	136607° <sub>5/2</sub> — 213127 <sub>3/2</sub>	1334.685	10	74924.0	
1307.117	2	76504.2		1334.832	10	74915.8	
1307.186	5	76500.2	139261° <sub>1/2</sub> — 215761 <sub>1/2</sub>	1335.181	0?	74896.2	122504° <sub>7/2</sub> — 197400 <sub>5/2</sub>
1307.573	100	76477.6	120577° <sub>5/2</sub> — 197055 <sub>7/2</sub>	1336.184	60	74840.0	126892° <sub>5/2</sub> — 201732 <sub>3/2</sub>
1307.610	50	76475.4	118864° <sub>7/2</sub> — 195340 <sub>5/2</sub>	1336.310	30	74832.9	138982° <sub>7/2</sub> — 213815 <sub>7/2</sub>
1309.069	15	76390.2	68963 <sub>5/2</sub> — 145353° <sub>3/2</sub>	1336.859	40	74802.2	136483° <sub>3/2</sub> — 211286 <sub>1/2</sub>
1309.113	25	76387.6	139757° <sub>5/2</sub> — 216145 <sub>5/2</sub>	1337.116	3	74787.8	140201° <sub>3/2</sub> — 214989 <sub>5/2</sub>
1309.882	50	76342.8	136607° <sub>5/2</sub> — 212951 <sub>5/2</sub>	1337.508	50	74765.9	120577° <sub>5/2</sub> — 195343 <sub>7/2</sub>
1311.124	60	76270.4	137041° <sub>1/2</sub> — 213312 <sub>1/2</sub>	1337.567	150	74762.6	120577° <sub>5/2</sub> — 195340 <sub>5/2</sub>
1311.847	75	76228.4	120577° <sub>5/2</sub> — 196806 <sub>3/2</sub>	1338.849	75	74691.0	121337° <sub>9/2</sub> — 196028 <sub>5/2</sub>
1312.001	10	76219.5	139757° <sub>5/2</sub> — 215976 <sub>7/2</sub>	1339.271	30	74667.5	138084° <sub>5/2</sub> — 212752 <sub>7/2</sub>
				1339.345	20	74663.4	136607° <sub>5/2</sub> — 211271 <sub>7/2</sub>

TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (vac)	Intensity	Wavenumber	Transition	$\lambda$ (vac)	Intensity	Wavenumber	Transition
1339.484	200	74655.6	118864° <sub>7/2</sub> – 193520 <sub>7/2</sub>	1365.275	20	73245.3	123550° <sub>9/2</sub> – 196795 <sub>9/2</sub>
1339.761	60	74640.2	136483° <sub>3/2</sub> – 211123 <sub>3/2</sub>	1365.836	60	73215.2	148663° <sub>5/2</sub> – 221878 <sub>5/2</sub>
1340.880	15	74577.9	121864° <sub>3/2</sub> – 196442 <sub>3/2</sub>	1366.241	40	73193.5	139757° <sub>5/2</sub> – 212951 <sub>5/2</sub>
1341.157	100	74562.5	122637° <sub>1/2</sub> – 197199 <sub>1/2</sub>	1366.375	100	73186.3	138084° <sub>5/2</sub> – 211271 <sub>7/2</sub>
1341.470	100	74545.1	123440° <sub>3/2</sub> – 197985 <sub>3/2</sub>	1367.627	150	73119.4	121699° <sub>11/2</sub> – 194818 <sub>11/2</sub>
1341.515	100	74542.6	62065° <sub>7/2</sub> – 136607° <sub>5/2</sub>	1367.791	30	73110.6	140201° <sub>3/2</sub> – 213312 <sub>1/2</sub>
1341.766	5	74528.6	140201° <sub>3/2</sub> – 214730 <sub>1/2</sub>	1368.257	50	73085.7	122637° <sub>1/2</sub> – 195722 <sub>1/2</sub>
1341.817	25	74525.8	138989° <sub>3/2</sub> – 213514 <sub>3/2</sub>	1368.778	3?	73057.9	80552° <sub>7/2</sub> – 153609° <sub>7/2</sub>
1341.997	40	74515.8	136607° <sub>3/2</sub> – 211123 <sub>3/2</sub>	1368.898	100	73051.5	122504° <sub>7/2</sub> – 195555 <sub>5/2</sub>
1342.093	75	74510.5	148663° <sub>5/2</sub> – 223174 <sub>7/2</sub>	1369.130	40	73039.1	138084° <sub>5/2</sub> – 211123 <sub>3/2</sub>
1342.177	150	74505.8	118864° <sub>7/2</sub> – 193370 <sub>9/2</sub>	1369.189	50	73035.9	124557° <sub>7/2</sub> – 197593 <sub>7/2</sub>
1342.503	3	74487.7	124442° <sub>9/2</sub> – 198930 <sub>7/2</sub>	1369.593	100	73014.4	122504° <sub>7/2</sub> – 195518 <sub>9/2</sub>
1343.007	100	74459.8	123440° <sub>5/2</sub> – 197900 <sub>5/2</sub>	1369.838	50	73001.3	123440° <sub>5/2</sub> – 196442 <sub>3/2</sub>
1343.164	25	74451.1	121337° <sub>9/2</sub> – 195788 <sub>7/2</sub>	1369.958	60	72994.9	139757° <sub>5/2</sub> – 212752 <sub>7/2</sub>
1343.721	100	74420.2	121337° <sub>9/2</sub> – 195757 <sub>11/2</sub>	1370.855	30	72947.2	139261° <sub>1/2</sub> – 212208 <sub>1/2</sub>
1344.351	100	74385.3	126829° <sub>7/2</sub> – 201215 <sub>5/2</sub>	1370.936	40	72942.9	120577° <sub>5/2</sub> – 193520 <sub>7/2</sub>
1345.483	80	74322.8	126892° <sub>5/2</sub> – 201215 <sub>5/2</sub>	1371.123	75	72932.9	124442° <sub>9/2</sub> – 197375 <sub>9/2</sub>
1346.050	100	74291.4	122504° <sub>7/2</sub> – 196795 <sub>9/2</sub>	1371.267	25	72925.3	140201° <sub>3/2</sub> – 213127 <sub>3/2</sub>
1346.903	60	74244.4	124442° <sub>9/2</sub> – 198687 <sub>9/2</sub>	1371.441	50	72916.0	147647° <sub>11/2</sub> – 220563 <sub>9/2</sub>
1347.013	100	74238.3	122504° <sub>7/2</sub> – 196742 <sub>7/2</sub>	1372.878	75	72839.7	122504° <sub>7/2</sub> – 195243 <sub>7/2</sub>
1347.059	75	74235.8	121864° <sub>3/2</sub> – 196100 <sub>3/2</sub>	1372.947	100	72836.0	126094° <sub>7/2</sub> – 198930 <sub>7/2</sub>
1348.061	60	74180.6	121337° <sub>9/2</sub> – 195518 <sub>9/2</sub>	1373.282	75	72818.3	124557° <sub>7/2</sub> – 197375 <sub>9/2</sub>
1348.268	30	74169.2	122637° <sub>1/2</sub> – 196806 <sub>9/2</sub>	1374.014	75	72779.5	128435° <sub>3/2</sub> – 202125 <sub>5/2</sub>
1348.566	150	74152.8	123440° <sub>5/2</sub> – 197593 <sub>7/2</sub>				121337° <sub>9/2</sub> – 194117 <sub>7/2</sub>
1348.714	40	74144.7	138989° <sub>3/2</sub> – 213133 <sub>5/2</sub>	1374.275	100	72765.6	147647° <sub>11/2</sub> – 220413 <sub>13/2</sub>
1348.831	50	74138.3	138989° <sub>3/2</sub> – 213127 <sub>3/2</sub>	1374.436	25	72757.1	147806° <sub>7/2</sub> – 220563 <sub>9/2</sub>
1349.420	300	74105.9	120577° <sub>5/2</sub> – 194683 <sub>3/2</sub>	1374.751	100	72740.4	67016° <sub>7/2</sub> – 139757° <sub>5/2</sub>
1349.851	40	74082.2	137041° <sub>1/2</sub> – 211123 <sub>3/2</sub>	1375.108	3	72721.6	63886° <sub>3/2</sub> – 136607° <sub>5/2</sub>
1350.032	20	74072.3	147806° <sub>7/2</sub> – 221878 <sub>5/2</sub>	1375.337	2	72709.5	
1350.208	40	74062.7	140201° <sub>3/2</sub> – 214264 <sub>3/2</sub>	1375.598	150	72695.7	121337° <sub>9/2</sub> – 194033 <sub>11/2</sub>
1350.280	80	74058.7	121699° <sub>11/2</sub> – 195757 <sub>11/2</sub>	1375.693	40	72690.6	138989° <sub>3/2</sub> – 211679 <sub>5/2</sub>
1350.364	150	74054.1	147806° <sub>7/2</sub> – 221861 <sub>7/2</sub>	1375.824	30	72683.7	142513° <sub>3/2</sub> – 215197 <sub>3/2</sub>
1350.557	3	74043.5	123550° <sub>9/2</sub> – 197593 <sub>7/2</sub>	1375.909	100	72679.2	125382° <sub>5/2</sub> – 198061 <sub>5/2</sub>
1350.712	60	74035.0	146534° <sub>9/2</sub> – 220569 <sub>7/2</sub>	1376.208	30	72663.4	147647° <sub>11/2</sub> – 220311 <sub>11/2</sub>
1350.816	15	74029.3	146534° <sub>9/2</sub> – 220563 <sub>7/2</sub>	1376.278	10	72659.7	123440° <sub>5/2</sub> – 196100 <sub>3/2</sub>
1351.244	150	74005.9	121337° <sub>9/2</sub> – 195343 <sub>7/2</sub>	1376.530	50	72646.4	142550° <sub>1/2</sub> – 215197 <sub>3/2</sub>
1352.085	2	73959.8	123440° <sub>5/2</sub> – 197400 <sub>5/2</sub>	1376.787	300r	72632.9	121699° <sub>11/2</sub> – 194331 <sub>13/2</sub>
1352.691	4	73926.7		1377.174	40	72612.5	124442° <sub>9/2</sub> – 197055 <sub>7/2</sub>
1353.545	50	73880.1	139261° <sub>1/2</sub> – 213141 <sub>1/2</sub>	1377.489	200r	72595.9	124442° <sub>9/2</sub> – 197038 <sub>11/2</sub>
1353.943	100	73858.4	121864° <sub>3/2</sub> – 195722 <sub>1/2</sub>	1377.548	75	72592.8	126094° <sub>7/2</sub> – 198687 <sub>9/2</sub>
1354.658	30	73819.4	121699° <sub>11/2</sub> – 195518 <sub>7/2</sub>	1377.656	30	72587.1	142513° <sub>3/2</sub> – 215100 <sub>5/2</sub>
1354.923	30	73804.9	122637° <sub>1/2</sub> – 196442 <sub>3/2</sub>	1378.124	60	72562.4	142427° <sub>5/2</sub> – 214989 <sub>5/2</sub>
1355.442	100	73776.7	146534° <sub>9/2</sub> – 220311 <sub>11/2</sub>	1378.214	75	72557.7	122504° <sub>7/2</sub> – 195061 <sub>9/2</sub>
1355.631	20	73766.4		1378.644	75	72535.0	128679° <sub>5/2</sub> – 201215 <sub>5/2</sub>
1356.406	150	73724.2	121337° <sub>9/2</sub> – 195061 <sub>9/2</sub>	1379.362	75	72497.3	124557° <sub>7/2</sub> – 197055 <sub>7/2</sub>
1357.023	40	73690.7	121864° <sub>3/2</sub> – 195555 <sub>5/2</sub>	1379.726	60	72478.2	123550° <sub>9/2</sub> – 196028 <sub>9/2</sub>
1357.308	50	73675.2	136483° <sub>3/2</sub> – 210159 <sub>5/2</sub>	1379.769	70	72475.9	142513° <sub>3/2</sub> – 214989 <sub>5/2</sub>
1358.105	75	73632.0	136607° <sub>3/2</sub> – 210239 <sub>7/2</sub>	1380.883	100	72417.4	142427° <sub>5/2</sub> – 214844 <sub>7/2</sub>
1358.428	75	73614.5	123440° <sub>5/2</sub> – 197055 <sub>7/2</sub>	1381.395	50	72390.6	139261° <sub>1/2</sub> – 211652 <sub>3/2</sub>
1359.298	8	73567.4	138084° <sub>5/2</sub> – 211652 <sub>3/2</sub>	1381.437	30	72388.4	
1359.355	5	73564.3		1382.120	50	72352.6	124442° <sub>9/2</sub> – 196795 <sub>9/2</sub>
1359.529	15	73554.9	139757° <sub>5/2</sub> – 213312 <sub>3/2</sub>	1382.211	20	72347.9	123440° <sub>5/2</sub> – 195788 <sub>7/2</sub>
1359.615	75	73550.2	142427° <sub>5/2</sub> – 215976 <sub>7/2</sub>	1382.472	40	72334.2	121699° <sub>11/2</sub> – 194033 <sub>11/2</sub>
1359.815	75	73539.4	120577° <sub>5/2</sub> – 194117 <sub>7/2</sub>	1382.542	100	72330.5	138982° <sub>7/2</sub> – 211313 <sub>9/2</sub>
1360.087	25	73524.7	122504° <sub>7/2</sub> – 196028 <sub>7/2</sub>	1382.811	50	72316.5	125744° <sub>3/2</sub> – 198061 <sub>5/2</sub>
1360.454	25	73504.9	123550° <sub>9/2</sub> – 197055 <sub>7/2</sub>	1383.136	10?	72299.5	124442° <sub>9/2</sub> – 196742 <sub>7/2</sub>
1360.761	25	73488.3	123550° <sub>9/2</sub> – 197038 <sub>11/2</sub>	1383.184	30	72297.0	138989° <sub>3/2</sub> – 211286 <sub>1/2</sub>
1360.902	75	73480.7	121337° <sub>9/2</sub> – 194818 <sub>11/2</sub>	1383.341	40	72288.8	125744° <sub>3/2</sub> – 198033 <sub>1/2</sub>
1360.987	60	73476.1	121864° <sub>3/2</sub> – 195340 <sub>5/2</sub>				138982° <sub>7/2</sub> – 211271 <sub>7/2</sub>
1361.224	50	73463.3	68963° <sub>5/2</sub> – 142427° <sub>5/2</sub>	1384.264	75	72240.6	125744° <sub>3/2</sub> – 197985 <sub>3/2</sub>
1361.517	30	73447.5	166159° <sub>9/2</sub> – 239606° <sub>9/2</sub>	1384.324	100	72237.4	124557° <sub>7/2</sub> – 196795 <sub>9/2</sub>
1362.559	50	73391.3	136483° <sub>3/2</sub> – 209875 <sub>5/2</sub>	1384.718	15	72216.9	142513° <sub>3/2</sub> – 214730 <sub>1/2</sub>
1362.840	50	73376.2	139757° <sub>5/2</sub> – 213133 <sub>5/2</sub>	1384.822	150	72211.4	125382° <sub>5/2</sub> – 197593 <sub>7/2</sub>
1362.960	40	73369.7	139757° <sub>5/2</sub> – 213127 <sub>3/2</sub>	1384.897	100	72207.5	123550° <sub>9/2</sub> – 195757 <sub>11/2</sub>
1363.083	150	73363.1	121699° <sub>11/2</sub> – 195061 <sub>9/2</sub>	1385.366	60	72183.1	121337° <sub>9/2</sub> – 193520 <sub>7/2</sub>
1363.516	30	73339.8	63143° <sub>5/2</sub> – 136483° <sub>3/2</sub>	1385.896	100	72155.5	125744° <sub>3/2</sub> – 197900 <sub>5/2</sub>
1364.014	15	73313.0	140201° <sub>3/2</sub> – 213514 <sub>3/2</sub>	1386.292	35	72134.9	138989° <sub>3/2</sub> – 211123 <sub>3/2</sub>
1364.117	40	73307.5	120577° <sub>5/2</sub> – 193885 <sub>5/2</sub>	1386.689	50	72114.2	123440° <sub>5/2</sub> – 195555 <sub>5/2</sub>
1364.227	100	73301.6	123440° <sub>5/2</sub> – 196742 <sub>7/2</sub>	1386.948	50	72100.8	126829° <sub>7/2</sub> – 198930 <sub>7/2</sub>
1364.440	50	73290.1	123440° <sub>5/2</sub> – 196730 <sub>5/2</sub>	1387.459	60	72074.2	138084° <sub>5/2</sub> – 210159 <sub>5/2</sub>
1364.548	5	73284.3	122504° <sub>7/2</sub> – 195788 <sub>7/2</sub>	1387.992	25	72046.5	122637° <sub>1/2</sub> – 194683 <sub>3/2</sub>
1364.867	60	73267.2	136607° <sub>5/2</sub> – 209875 <sub>5/2</sub>	1388.153	40	72038.2	126892° <sub>5/2</sub> – 198930 <sub>7/2</sub>

TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (vac)	Intensity	Wavenumber	Transition	$\lambda$ (vac)	Intensity	Wavenumber	Transition
1388.254	80	72032.9	121337° <sub>9/2</sub> —193370 <sub>9/2</sub>	1412.709	75	70786.0	124557° <sub>7/2</sub> —195343 <sub>7/2</sub>
1388.412	50	72024.7	139261° <sub>1/2</sub> —211286 <sub>1/2</sub>	1412.776	60	70782.6	124557° <sub>7/2</sub> —195340 <sub>5/2</sub>
			142820° <sub>7/2</sub> —214844 <sub>7/2</sub>	1412.997	75	70771.6	139261° <sub>1/2</sub> —210033 <sub>3/2</sub>
1388.485	30	72020.9	121864° <sub>3/2</sub> —193885 <sub>5/2</sub>	1413.147	2	70764.0	126829° <sub>7/2</sub> —197593 <sub>7/2</sub>
1389.508	150	71967.9	123550° <sub>9/2</sub> —195518 <sub>9/2</sub>	1413.190	1	70761.9	142550° <sub>1/2</sub> —213312 <sub>1/2</sub>
1389.551	60	71965.7	67016 <sub>7/2</sub> —138982° <sub>7/2</sub>	1414.060	60	70718.4	125382° <sub>5/2</sub> —196100 <sub>3/2</sub>
1389.708	15	71957.6	144876° <sub>3/2</sub> —216833 <sub>1/2</sub>	1414.291	8	70706.8	142427° <sub>5/2</sub> —213133 <sub>5/2</sub>
1389.877	40	71948.8	138084° <sub>5/2</sub> —210033 <sub>3/2</sub> ?	1414.399	75	70701.4	126094° <sub>7/2</sub> —196795 <sub>9/2</sub>
1390.272	150	71928.4	142820° <sub>7/2</sub> —214747 <sub>9/2</sub>	1414.481	65	70697.3	125744° <sub>3/2</sub> —196442 <sub>3/2</sub>
1390.389	30	71922.3	139757° <sub>5/2</sub> —211679 <sub>5/2</sub>	1415.439	20	70649.5	144195° <sub>5/2</sub> —214844 <sub>7/2</sub>
1390.715	60	71905.5	148663° <sub>5/2</sub> —220569 <sub>7/2</sub>	1415.464	30	70648.2	126094° <sub>7/2</sub> —196742 <sub>7/2</sub>
1390.827	1	71899.7	123440° <sub>5/2</sub> —195340 <sub>5/2</sub>	1415.695	35	70636.7	126094° <sub>7/2</sub> —196730 <sub>5/2</sub>
1390.923	30	71894.7	139757° <sub>5/2</sub> —211652 <sub>3/2</sub>	1415.855	10	70628.7	142513° <sub>3/2</sub> —213141 <sub>1/2</sub>
1391.443	2	71867.8	167739 <sub>7/2</sub> —239606° <sub>9/2</sub>	1416.025	20	70620.2	142513° <sub>3/2</sub> —213133 <sub>5/2</sub>
1391.551	50	71862.3	139261° <sub>1/2</sub> —211123 <sub>3/2</sub>	1416.153	40	70613.8	142513° <sub>3/2</sub> —213127 <sub>3/2</sub>
1391.647	100	71857.3	126829° <sub>7/2</sub> —198687 <sub>9/2</sub>	1416.610	20	70591.1	142550° <sub>1/2</sub> —213141 <sub>1/2</sub>
1392.036	35	71837.2	142427° <sub>5/2</sub> —214264 <sub>3/2</sub>	1416.906	15	70576.3	142550° <sub>1/2</sub> —213127 <sub>3/2</sub>
1392.631	50	71806.5	126094° <sub>7/2</sub> —197900 <sub>5/2</sub>	1417.024	40	70570.4	126829° <sub>7/2</sub> —197400 <sub>5/2</sub>
1392.885	10	71793.4	123550° <sub>9/2</sub> —195343 <sub>7/2</sub>	1417.096	50	70566.8	123550° <sub>9/2</sub> —194117 <sub>7/2</sub>
1392.944	15?	71790.4	138084° <sub>5/2</sub> —209875 <sub>5/2</sub>	1417.513	100	70546.1	126829° <sub>7/2</sub> —197375 <sub>7/2</sub>
1393.117	80	71781.5	144195° <sub>5/2</sub> —215976 <sub>7/2</sub>	1417.960	30	70523.8	142427° <sub>5/2</sub> —212951 <sub>5/2</sub>
1394.428	5	71714.0	142550° <sub>1/2</sub> —214264 <sub>3/2</sub>	1418.279	15	70508.0	126892° <sub>5/2</sub> —197400 <sub>5/2</sub>
1395.250	150	71671.7	121699° <sub>11/2</sub> —193370 <sub>9/2</sub>	1418.358	50	70504.1	124557° <sub>7/2</sub> —195061 <sub>9/2</sub>
1395.567	40	71655.5	125744° <sub>3/2</sub> —197375 <sub>5/2</sub>	1418.782	100	70483.0	123550° <sub>9/2</sub> —194033 <sub>11/2</sub>
1396.394	60	71613.0	122504° <sub>7/2</sub> —194117 <sub>7/2</sub>	1419.378	5	70453.4	145353° <sub>3/2</sub> —215807 <sub>3/2</sub>
1398.333	60	71513.7	139757° <sub>5/2</sub> —211271 <sub>7/2</sub>	1419.552	3	70444.8	123440° <sub>5/2</sub> —193885 <sub>5/2</sub>
1398.379	80	71511.4	123550° <sub>9/2</sub> —195061 <sub>9/2</sub>	1419.691	10	70437.9	142513° <sub>3/2</sub> —212951 <sub>5/2</sub>
1398.602	50	71499.9	144876° <sub>3/2</sub> —216376 <sub>5/2</sub>	1420.316	30	70406.9	125382° <sub>5/2</sub> —195788 <sub>7/2</sub>
1399.000	60	71479.6	145353° <sub>3/2</sub> —216833 <sub>1/2</sub>	1420.945	30	70375.7	124442° <sub>9/2</sub> —194818 <sub>11/2</sub>
1399.035	50	71477.8	140201° <sub>3/2</sub> —211679 <sub>5/2</sub>	1421.353	10	70355.5	125744° <sub>3/2</sub> —196100 <sub>3/2</sub>
1399.171	150	71470.9	124557° <sub>7/2</sub> —196028 <sub>9/2</sub>	1421.701	3	70338.3	
1399.485	20	71454.9	125744° <sub>3/2</sub> —197199 <sub>1/2</sub>	1421.963	30	70325.3	142427° <sub>5/2</sub> —212752 <sub>7/2</sub>
1399.574	40	71450.3	140201° <sub>3/2</sub> —211652 <sub>3/2</sub>	1422.049	5	70321.1	144876° <sub>3/2</sub> —215197 <sub>3/2</sub>
1400.081	15	71424.4	125382° <sub>5/2</sub> —196806 <sub>3/2</sub>	1422.202	40	70313.5	142820° <sub>7/2</sub> —213133 <sub>5/2</sub>
1400.783	20	71388.6	142427° <sub>5/2</sub> —213815 <sub>7/2</sub>	1422.964	30	70275.8	139757° <sub>5/2</sub> —210033 <sub>5/2</sub>
1400.926	20	71381.4	122504° <sub>7/2</sub> —193885 <sub>5/2</sub>	1423.475	150	70250.6	128679° <sub>5/2</sub> —198930 <sub>7/2</sub>
1401.333	25	71360.6	125382° <sub>5/2</sub> —196742 <sub>7/2</sub>	1423.984	75	70225.5	126829° <sub>7/2</sub> —197055 <sub>7/2</sub>
1401.364	25	71359.0	144876° <sub>3/2</sub> —216235 <sub>3/2</sub>	1425.050	75	70173.0	125382° <sub>5/2</sub> —195555 <sub>7/2</sub>
1401.566	60	71348.8	125382° <sub>5/2</sub> —196730 <sub>5/2</sub>	1425.253	50	70163.0	126892° <sub>5/2</sub> —197055 <sub>7/2</sub>
1401.623	100	71345.9	124442° <sub>9/2</sub> —195788 <sub>7/2</sub>	1425.352	20	70158.1	146675° <sub>1/2</sub> —216833 <sub>1/2</sub>
1402.226	100	71315.2	124442° <sub>9/2</sub> —195757 <sub>11/2</sub>	1425.904	50	70130.9	142820° <sub>7/2</sub> —212951 <sub>5/2</sub>
1402.407	60	71306.0	126094° <sub>7/2</sub> —197400 <sub>5/2</sub>	1425.997	10	70126.4	
1402.885	50	71281.7	126094° <sub>7/2</sub> —197375 <sub>9/2</sub>	1426.171	30	70117.8	139757° <sub>5/2</sub> —209875 <sub>5/2</sub>
1403.152	100	71268.1	123550° <sub>9/2</sub> —194818 <sub>11/2</sub>	1426.259	20	70113.5	144876° <sub>3/2</sub> —214989 <sub>5/2</sub>
1403.371 <sup>a</sup>	100	71257.0	138982° <sub>7/2</sub> —210239 <sub>7/2</sub>	1427.161	60	70069.2	144195° <sub>5/2</sub> —214264 <sub>3/2</sub>
1403.750	30	71237.8	68963 <sub>5/2</sub> —140201° <sub>3/2</sub>	1427.762	20	70039.7	167739 <sub>7/2</sub> —237778° <sub>9/2</sub>
1403.873	15	71231.5	126829° <sub>7/2</sub> —198061 <sub>5/2</sub>	1428.064	150	70024.9	68963 <sub>5/2</sub> —138989° <sub>9/2</sub>
1404.963	30	71176.3	138982° <sub>7/2</sub> —210159 <sub>5/2</sub>	1429.020	75	69978.0	125744° <sub>3/2</sub> —195722 <sub>1/2</sub>
1405.082	30	71170.2	138989° <sub>3/2</sub> —210159 <sub>5/2</sub>	1429.179	100	69970.2	123550° <sub>9/2</sub> —193520 <sub>7/2</sub>
1405.099	30	71169.4	126892° <sub>5/2</sub> —198061 <sub>5/2</sub>	1429.904	100	69934.8	126094° <sub>7/2</sub> —196028 <sub>9/2</sub>
1406.708	8	71088.0	142427° <sub>5/2</sub> —213514 <sub>3/2</sub>	1429.960	80	69932.0	142820° <sub>7/2</sub> —212752 <sub>7/2</sub>
1406.946	8	71075.9	124442° <sub>9/2</sub> —195518 <sub>9/2</sub>	1430.330	60?	69913.9	126892° <sub>5/2</sub> —196806 <sub>3/2</sub>
1407.044	20	71071.0	126829° <sub>7/2</sub> —197900 <sub>5/2</sub>	1430.364	40?	69912.3	126829° <sub>7/2</sub> —196742 <sub>7/2</sub> ?
1407.105	50	71067.9	67016 <sub>7/2</sub> —138084° <sub>5/2</sub>	1430.587	5	69901.4	126829° <sub>7/2</sub> —196730 <sub>5/2</sub> ?
1407.574	35	71044.2	138989° <sub>3/2</sub> —210033 <sub>3/2</sub>	1430.948	100	69883.7	78780 <sub>3/2</sub> —148663° <sub>5/2</sub> ?
1408.006	100	71022.4	145353° <sub>3/2</sub> —216376 <sub>5/2</sub>	1431.550	20	69854.4	144876° <sub>3/2</sub> —214730 <sub>1/2</sub>
1408.119	15	71016.7	122504° <sub>7/2</sub> —193520 <sub>7/2</sub>	1431.662	100	69848.9	77968 <sub>5/2</sub> —147817° <sub>3/2</sub>
1408.291	50	71008.1	126892° <sub>5/2</sub> —197900 <sub>5/2</sub>	1431.875	75	69838.5	77968 <sub>5/2</sub> —147806° <sub>7/2</sub>
1408.505	50	70997.3	124557° <sub>7/2</sub> —195555 <sub>5/2</sub>				126892° <sub>5/2</sub> —196730 <sub>5/2</sub>
1409.224	50	70961.0	126094° <sub>7/2</sub> —197055 <sub>7/2</sub>	1432.017	50	69831.6	140201° <sub>3/2</sub> —210033 <sub>3/2</sub>
1409.637	30	70940.2		1432.249	100	69820.3	123550° <sub>9/2</sub> —193370 <sub>9/2</sub>
1409.820	15	70931.0	144876° <sub>3/2</sub> —215807 <sub>3/2</sub>	1432.453	30	69810.3	125744° <sub>3/2</sub> —195555 <sub>5/2</sub>
1410.336	40	70905.1	144195° <sub>5/2</sub> —215100 <sub>5/2</sub>	1432.759	8	69795.4	
1410.336	40	70905.1	142513° <sub>3/2</sub> —213418 <sub>1/2</sub>	1432.847	2	69791.1	
1410.377	20?	70903.0		1433.760	30	69746.7	145353° <sub>3/2</sub> —215100 <sub>5/2</sub>
1410.415	50	70901.1	124442° <sub>9/2</sub> —195343 <sub>7/2</sub>	1434.831	75	69694.6	126094° <sub>7/2</sub> —195788 <sub>7/2</sub>
1410.597	75	70892.0	138982° <sub>7/2</sub> —209875 <sub>5/2</sub>	1435.265	30	69673.5	140201° <sub>3/2</sub> —209875 <sub>5/2</sub>
1410.732	40	70885.2	144876° <sub>3/2</sub> —215761 <sub>1/2</sub>	1436.251	50	69625.7	128435° <sub>3/2</sub> —198061 <sub>5/2</sub>
1411.085	30	70867.5	142550° <sub>1/2</sub> —213418 <sub>1/2</sub>	1436.363	60	69620.3	144195° <sub>5/2</sub> —213815 <sub>7/2</sub>
1412.451	15	70798.9	142513° <sub>3/2</sub> —213312 <sub>3/2</sub>	1436.820	100	69598.1	128435° <sub>3/2</sub> —198033 <sub>1/2</sub>
1412.555	40	70793.7	68963 <sub>5/2</sub> —139757° <sub>5/2</sub>	1436.973	100	69590.7	124442° <sub>9/2</sub> —194033 <sub>11/2</sub>
1412.605	30	70791.2	145353° <sub>3/2</sub> —216145 <sub>5/2</sub>	1437.518	75	69564.3	153609° <sub>7/2</sub> —223174 <sub>7/2</sub>
				1437.623	100	69559.3	124557° <sub>7/2</sub> —194117 <sub>7/2</sub>



TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (vac)	Intensity	Wavenumber	Transition	$\lambda$ (vac)	Intensity	Wavenumber	Transition
1437.817	20	69549.9	126892° <sub>3/2</sub> – 196442 <sub>3/2</sub>	1469.452	50	68052.6	153808° <sub>9/2</sub> – 221861 <sub>7/2</sub> ?
1439.264	80	69480.0	128435° <sub>3/2</sub> – 197985 <sub>3/2</sub>	1470.502	10	68004.0	
1439.572	20	69465.1	153609° <sub>7/2</sub> – 223089 <sub>9/2</sub>	1470.807	60	67989.9	147817° <sub>3/2</sub> – 215807 <sub>3/2</sub>
1440.417	75	69424.3	128435° <sub>3/2</sub> – 197900 <sub>5/2</sub>	1471.488	10	67958.4	145353° <sub>3/2</sub> – 213312 <sub>1/2</sub>
1441.076	75	69392.6	126094° <sub>7/2</sub> – 195518 <sub>9/2</sub>	1471.797	45	67944.2	147817° <sub>3/2</sub> – 215761 <sub>1/2</sub>
1441.163	40	69388.4	153808° <sub>9/2</sub> – 223200 <sub>9/2</sub>	1472.858	100	67895.2	78780 <sub>3/2</sub> – 146675° <sub>1/2</sub>
1441.306	40	69381.5	144876° <sub>3/2</sub> – 214264 <sub>3/2</sub>	1474.796	8	67806.0	
1441.411	30	69376.5	128679° <sub>5/2</sub> – 198061 <sub>5/2</sub>	1475.113	50	67791.4	126892° <sub>5/2</sub> – 194683 <sub>3/2</sub>
1441.611	75	69366.8	145353° <sub>3/2</sub> – 214730 <sub>1/2</sub>	1475.189	10	67787.9	145353° <sub>3/2</sub> – 213141 <sub>1/2</sub>
1442.414	100	69328.2	153808° <sub>9/2</sub> – 223175 <sub>11/2</sub>	1475.369	20	67779.7	145353° <sub>3/2</sub> – 213133° <sub>5/2</sub>
1442.968	40	69301.6	124557° <sub>7/2</sub> – 193885 <sub>5/2</sub>	1475.509	25	67773.2	145353° <sub>3/2</sub> – 213127 <sub>3/2</sub>
1443.384	30	69281.6	125382° <sub>5/2</sub> – 194683 <sub>3/2</sub>	1475.747	20	67762.3	128679° <sub>5/2</sub> – 196442 <sub>3/2</sub>
1444.053	10	69249.5	153808° <sub>9/2</sub> – 223089 <sub>3/2</sub>	1476.405	10	67732.1	142427° <sub>5/2</sub> – 210159 <sub>5/2</sub>
1444.565	15	69225.0	126094° <sub>7/2</sub> – 195343 <sub>7/2</sub>	1477.876	40	67664.7	128435° <sub>3/2</sub> – 196100 <sub>3/2</sub>
1444.653	50	69220.8	142427° <sub>5/2</sub> – 211652 <sub>3/2</sub>	1478.325	40	67644.1	68963 <sub>5/2</sub> – 136607° <sub>5/2</sub>
1444.919	60	69208.0	128679° <sub>5/2</sub> – 197900 <sub>3/2</sub>	1479.351	15	67597.2	145353° <sub>3/2</sub> – 212951 <sub>3/2</sub>
1445.108	40	69199.0	126892° <sub>5/2</sub> – 196100 <sub>3/2</sub>	1479.524	15	67589.3	146675° <sub>1/2</sub> – 214264 <sub>3/2</sub>
1445.217	35	69193.8	126829° <sub>7/2</sub> – 196028 <sub>9/2</sub>	1479.917	50	67571.4	148663° <sub>5/2</sub> – 216235 <sub>3/2</sub>
1445.501	40	69180.2	147653° <sub>1/2</sub> – 216833 <sub>1/2</sub>	1481.050	50	67519.7	68963 <sub>5/2</sub> – 136483° <sub>3/2</sub>
1446.508	5	69132.0	146675° <sub>1/2</sub> – 215807 <sub>3/2</sub>	1481.229	300r	67511.5	80305 <sub>3/2</sub> – 147817° <sub>3/2</sub>
1446.737	25	69121.1	68963 <sub>5/2</sub> – 138084° <sub>5/2</sub>	1482.622	4	67448.1	142427° <sub>5/2</sub> – 209875 <sub>5/2</sub>
1446.824	25	69116.9	144195° <sub>5/2</sub> – 213312 <sub>3/2</sub>	1483.084	4	67427.1	126094° <sub>7/2</sub> – 193520 <sub>7/2</sub>
1447.147	5	69101.5	142550° <sub>1/2</sub> – 211652 <sub>3/2</sub>	1483.232	40	67420.3	128679° <sub>5/2</sub> – 196100 <sub>3/2</sub>
1447.636	20	69078.1	124442° <sub>5/2</sub> – 193520 <sub>3/2</sub>	1483.816	150	67393.8	80423 <sub>1/2</sub> – 147817° <sub>3/2</sub>
1448.493	60	69037.3	124442° <sub>5/2</sub> – 193520 <sub>3/2</sub>	1483.997	75	67385.6	77968 <sub>5/2</sub> – 145353° <sub>3/2</sub>
1448.933	10	69016.3	78780 <sub>3/2</sub> – 147817° <sub>3/2</sub>	1484.831	40	67347.7	80305 <sub>3/2</sub> – 147653° <sub>1/2</sub>
1450.021	150	68964.5	147817° <sub>3/2</sub> – 216833 <sub>1/2</sub>	1485.022	5	67339.1	142820° <sub>7/2</sub> – 210159 <sub>5/2</sub>
1450.141	75	68958.8	128435° <sub>3/2</sub> – 197400 <sub>3/2</sub>	1485.170	20	67332.4	144876° <sub>3/2</sub> – 212208 <sub>1/2</sub>
1450.561	40	68938.8	126829° <sub>7/2</sub> – 195788 <sub>7/2</sub>	1485.595	15	67313.1	148663° <sub>5/2</sub> – 215976 <sub>7/2</sub>
1450.788	15	68928.1	125744° <sub>3/2</sub> – 194683 <sub>3/2</sub>	1486.021	50	67293.8	147806° <sub>7/2</sub> – 215100 <sub>5/2</sub>
1451.084	5	68914.0	124442° <sub>5/2</sub> – 193370 <sub>9/2</sub>	1486.165	40	67287.3	126829° <sub>7/2</sub> – 194117 <sub>7/2</sub>
1451.155	20	68910.6	128679° <sub>5/2</sub> – 197593 <sub>7/2</sub>	1486.257	35	67283.1	147817° <sub>3/2</sub> – 215100 <sub>5/2</sub>
1451.457	60	68896.3	145353° <sub>3/2</sub> – 214264 <sub>3/2</sub>	1486.396	5	67276.8	126094° <sub>7/2</sub> – 193370 <sub>9/2</sub>
1451.943	10	68873.2	126892° <sub>5/2</sub> – 195788 <sub>7/2</sub>	1486.655	150r	67265.1	80552 <sub>5/2</sub> – 147817° <sub>3/2</sub>
1452.228	20	68859.7	78780 <sub>3/2</sub> – 147653° <sub>1/2</sub>	1486.892	100r	67254.4	80552 <sub>5/2</sub> – 147806° <sub>7/2</sub>
1452.544	10	68844.7	142820° <sub>7/2</sub> – 211679 <sub>5/2</sub>	1487.282	5	67236.7	
1453.213	15	68813.0	142427° <sub>5/2</sub> – 211271 <sub>7/2</sub> ?	1487.541	60	67225.0	126892° <sub>5/2</sub> – 194117 <sub>7/2</sub>
1453.525	2	68798.3	124557° <sub>7/2</sub> – 193370 <sub>9/2</sub>	1488.471	30	67183.0	147806° <sub>7/2</sub> – 214989 <sub>5/2</sub>
1454.246	15	68764.2	167739 <sub>7/2</sub> – 236537° <sub>7/2</sub>	1488.706	10	67172.4	147817° <sub>3/2</sub> – 214989 <sub>5/2</sub>
1454.425	25	68755.7	128435° <sub>3/2</sub> – 197199 <sub>1/2</sub>	1489.347	20	67143.5	148663° <sub>5/2</sub> – 215807 <sub>3/2</sub>
1454.861	25	68735.1	144195° <sub>5/2</sub> – 212951 <sub>5/2</sub>	1489.880	40	67119.5	128435° <sub>3/2</sub> – 195555 <sub>5/2</sub>
1455.063	10	68725.5	125382° <sub>5/2</sub> – 194117 <sub>7/2</sub>	1490.344	15	67098.6	122504° <sub>7/2</sub> – 189602 <sub>7/2</sub>
1455.174	50	68720.3	126829° <sub>7/2</sub> – 195555 <sub>5/2</sub>	1490.844	15	67076.1	144195° <sub>5/2</sub> – 211271 <sub>7/2</sub>
1455.669	15	68696.9	128679° <sub>5/2</sub> – 197400 <sub>5/2</sub>	1491.300	40	67055.6	142820° <sub>7/2</sub> – 209875 <sub>5/2</sub>
1455.842	40	68688.8	142427° <sub>5/2</sub> – 211123 <sub>3/2</sub>	1491.300	40	67055.6	126829° <sub>7/2</sub> – 193885 <sub>5/2</sub>
1456.390	15	68662.9	126829° <sub>7/2</sub> – 195518 <sub>9/2</sub>	1493.437	60	66959.6	153609° <sub>7/2</sub> – 220569 <sub>7/2</sub>
1456.905	45	68638.7	126892° <sub>5/2</sub> – 195555 <sub>5/2</sub>	1493.559	2	66954.2	153609° <sub>7/2</sub> – 220563 <sub>9/2</sub>
1457.499	8	68610.7	144876° <sub>3/2</sub> – 213514 <sub>3/2</sub>	1493.843	40	66941.4	147806° <sub>7/2</sub> – 214747 <sub>9/2</sub>
1458.370	30	68569.7	142513° <sub>3/2</sub> – 211123 <sub>3/2</sub>	1494.481	5	66912.9	147817° <sub>3/2</sub> – 214730 <sub>1/2</sub>
1458.602	60	68558.8	147806° <sub>7/2</sub> – 216376 <sub>5/2</sub>	1494.590	60	66908.0	77968 <sub>5/2</sub> – 144876° <sub>3/2</sub>
1459.556	50	68514.0	147817° <sub>3/2</sub> – 216376 <sub>5/2</sub>	1495.320	10	66875.3	128679° <sub>5/2</sub> – 195555 <sub>5/2</sub>
1459.630	20	68510.5	126829° <sub>7/2</sub> – 195343 <sub>7/2</sub>	1495.778	20	66854.8	145353° <sub>3/2</sub> – 212208 <sub>1/2</sub>
1459.778	10	68503.6	126829° <sub>7/2</sub> – 195340 <sub>5/2</sub>	1496.545	2	66820.6	
1459.991	20	68493.6	125382° <sub>5/2</sub> – 193885 <sub>5/2</sub>	1496.927	4	66803.5	144876° <sub>3/2</sub> – 211679 <sub>5/2</sub>
1460.893	75	68451.3	142820° <sub>7/2</sub> – 211313 <sub>5/2</sub>	1497.548	35	66775.8	144876° <sub>3/2</sub> – 211652 <sub>3/2</sub>
			142820° <sub>7/2</sub> – 211271 <sub>7/2</sub>	1497.900	40	66760.1	121337° <sub>9/2</sub> – 188097 <sub>9/2</sub>
			126892° <sub>5/2</sub> – 195343 <sub>7/2</sub>	1498.004	75	66755.5	153808° <sub>9/2</sub> – 220563 <sub>9/2</sub>
1460.953	10	68448.5	126892° <sub>5/2</sub> – 195340 <sub>5/2</sub>	1498.604	50	66728.8	
1461.604	15	68418.0	147817° <sub>3/2</sub> – 216235 <sub>5/2</sub>	1499.452	6	66691.0	126829° <sub>7/2</sub> – 193520 <sub>7/2</sub>
1462.514	4	68375.4	128679° <sub>5/2</sub> – 197055 <sub>7/2</sub>	1500.060	40	66664.00	128679° <sub>5/2</sub> – 195343 <sub>7/2</sub>
1462.885	60	68358.1	80305 <sub>3/2</sub> – 148663° <sub>5/2</sub>	1500.670	10	66636.90	146675° <sub>1/2</sub> – 213312 <sub>1/2</sub>
1463.537	60	68327.6	147817° <sub>3/2</sub> – 216145 <sub>5/2</sub>	1501.171	100	66614.66	62065 <sub>7/2</sub> – 128679° <sub>5/2</sub>
1464.234	50	68295.1	128435° <sub>3/2</sub> – 196730 <sub>5/2</sub>	1501.255	20	66610.93	147653° <sub>1/2</sub> – 214264 <sub>3/2</sub>
1464.792	50	68269.1	153609° <sub>7/2</sub> – 221878 <sub>5/2</sub>	1502.093	100	66573.77	78780 <sub>3/2</sub> – 145353° <sub>3/2</sub>
1465.040	3	68257.5	144876° <sub>3/2</sub> – 213133 <sub>5/2</sub>	1502.832	15	66541.04	126829° <sub>7/2</sub> – 193370 <sub>9/2</sub>
1465.174	20	68251.3	153609° <sub>7/2</sub> – 221861 <sub>7/2</sub>	1503.691	10	66503.02	153808° <sub>9/2</sub> – 220311 <sub>11/2</sub>
1466.919	15	68170.1	147806° <sub>7/2</sub> – 215976 <sub>7/2</sub>	1504.521	15	66466.34	146675° <sub>1/2</sub> – 213141 <sub>1/2</sub>
1467.118	35	68160.8	145353° <sub>3/2</sub> – 213514 <sub>3/2</sub>	1504.853	15	66451.67	146675° <sub>1/2</sub> – 213127 <sub>3/2</sub>
1467.188	15	68157.6		1504.955	15	66447.17	147817° <sub>3/2</sub> – 214264 <sub>3/2</sub>
1467.596	5	68138.6	125382° <sub>5/2</sub> – 193520 <sub>7/2</sub>	1505.197	5	66436.49	148663° <sub>5/2</sub> – 215100 <sub>5/2</sub>
1467.857	30	68126.5	128679° <sub>5/2</sub> – 196806 <sub>3/2</sub>	1505.804	5	66409.70	144876° <sub>3/2</sub> – 211286 <sub>1/2</sub>
1469.238	40	68062.5	128679° <sub>5/2</sub> – 196742 <sub>7/2</sub>	1506.716	50	66369.51	80305 <sub>3/2</sub> – 146675° <sub>1/2</sub>
1469.406	40	68054.7	146675° <sub>1/2</sub> – 214730 <sub>1/2</sub>	1507.711	3	66325.71	145353° <sub>3/2</sub> – 211679 <sub>5/2</sub>



TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (vac)	Intensity	Wavenumber	Transition	$\lambda$ (vac)	Intensity	Wavenumber	Transition
1508.336	30	66298.22	148663° <sub>5/2</sub> — 214989 <sub>5/2</sub>	1625.496	30	61519.68	86133 <sub>1/2</sub> — 147653° <sub>1/2</sub>
1508.830	1	66276.52	145353° <sub>3/2</sub> — 211652 <sub>3/2</sub>	1626.130	300	61495.70	63886 <sub>3/2</sub> — 125382° <sub>5/2</sub>
1509.392	40	66251.84	166159 <sub>9/2</sub> — 232435° <sub>7/2</sub>	16485.30	300	62065 <sub>7/2</sub> — 123550° <sub>9/2</sub>	
1509.484	30	66247.80	80423 <sub>1/2</sub> — 146675° <sub>1/2</sub>	1628.085	100	61421.85	78780 <sub>3/2</sub> — 140201° <sub>3/2</sub>
			144876° <sub>3/2</sub> — 211123 <sub>3/2</sub>	1628.290	300	61414.12	63143 <sub>5/2</sub> — 124557° <sub>7/2</sub>
			128435° <sub>3/2</sub> — 194683 <sub>3/2</sub>	1629.313	20	61375.56	62065 <sub>7/2</sub> — 123440° <sub>3/2</sub>
1509.955	125	66227.14	77968 <sub>5/2</sub> — 144195° <sub>5/2</sub>	1630.356	75	61336.30	122860 <sub>1/2</sub> — 184197° <sub>3/2</sub>
1512.948	20	66096.12	78780 <sub>3/2</sub> — 144876° <sub>3/2</sub>	1632.176	3	61267.90	126829° <sub>7/2</sub> — 188097 <sub>9/2</sub>
1514.593	100	66024.34	60805 <sub>9/2</sub> — 126829° <sub>7/2</sub>	1633.239	8	61228.03	85447 <sub>3/2</sub> — 146675° <sub>1/2</sub>
1514.946	20	66008.95	147806° <sub>7/2</sub> — 213815 <sub>7/2</sub>	1638.788	8	61020.71	77968 <sub>5/2</sub> — 139757° <sub>5/2</sub>
1515.063	40	66003.86	128679° <sub>5/2</sub> — 194683 <sub>3/2</sub>	1638.945	300	61014.86	77968 <sub>5/2</sub> — 138982° <sub>7/2</sub>
1516.711	10	65932.14	145353° <sub>3/2</sub> — 211286 <sub>1/2</sub>	1639.950	30	60977.47	78780 <sub>3/2</sub> — 139757° <sub>5/2</sub>
1523.023	3	65658.89	147653° <sub>1/2</sub> — 213312 <sub>1/2</sub>	1641.419	1	60922.90	128679° <sub>5/2</sub> — 189602 <sub>7/2</sub>
1523.549	50	65636.22		1642.206	1000r	60893.70	60805 <sub>9/2</sub> — 121699° <sub>11/2</sub>
1523.921	5	65620.20		1651.754	50	60541.70	86133 <sub>1/2</sub> — 146675° <sub>1/2</sub>
1524.372	8	65600.78	147817° <sub>3/2</sub> — 213418 <sub>1/2</sub>	1652.003	500	60532.58	60805 <sub>9/2</sub> — 121337° <sub>9/2</sub>
1524.539	4	65593.60	122504° <sub>7/2</sub> — 188097 <sub>9/2</sub>	1653.400	75	60481.43	78780 <sub>3/2</sub> — 139261° <sub>1/2</sub>
1525.884	100	65535.78	63143 <sub>5/2</sub> — 128679° <sub>5/2</sub>	1654.559	300	60439.06	62065 <sub>7/2</sub> — 122504° <sub>7/2</sub>
1525.945	20?	65533.16	146675° <sub>1/2</sub> — 212208 <sub>1/2</sub>	1658.457	300	60297.01	63143 <sub>5/2</sub> — 123440° <sub>5/2</sub>
1526.839	25	65494.79	147817° <sub>3/2</sub> — 213312 <sub>1/2</sub>	1660.885	100	60208.86	78780 <sub>3/2</sub> — 138989° <sub>3/2</sub>
1526.998	35	65487.97	147653° <sub>1/2</sub> — 213141 <sub>1/2</sub>	1663.431	3	60116.71	77968 <sub>5/2</sub> — 138084° <sub>3/2</sub>
1528.695	10	65415.27	78780 <sub>3/2</sub> — 144195° <sub>5/2</sub>	1665.576	50	60039.29	122860 <sub>1/2</sub> — 182900° <sub>1/2</sub>
1531.002	5	65316.70	147817° <sub>3/2</sub> — 213133 <sub>?</sub>	1669.267	40	59906.53	85447 <sub>3/2</sub> — 145353° <sub>3/2</sub>
1531.159	20	65310.00	147817° <sub>3/2</sub> — 213127 <sub>3/2</sub>	1670.130	200	59875.58	67016 <sub>7/2</sub> — 126892° <sub>3/2</sub>
1531.588	30	65291.71	63143 <sub>5/2</sub> — 128435° <sub>3/2</sub>	1671.873	250	59813.16	67016 <sub>7/2</sub> — 126829° <sub>7/2</sub>
1531.653	10	65288.94	60805 <sub>9/2</sub> — 126094° <sub>7/2</sub>	1672.850	5	59778.22	80423 <sub>1/2</sub> — 140201° <sub>3/2</sub>
1535.310	2	65133.43	147817° <sub>3/2</sub> — 212951 <sub>5/2</sub>	1674.588	200	59716.18	68963 <sub>5/2</sub> — 128679° <sub>3/2</sub>
1537.332	1	65047.76	80305 <sub>3/2</sub> — 145353° <sub>3/2</sub>	1676.452	100	59649.78	80552 <sub>5/2</sub> — 140201° <sub>3/2</sub>
1541.976	100	64851.85	77968 <sub>5/2</sub> — 142820° <sub>7/2</sub>	1677.365	150	59617.32	89046 <sub>7/2</sub> — 148663° <sub>3/2</sub>
1542.569	15	64826.92	62065 <sub>7/2</sub> — 126892° <sub>5/2</sub>	1679.139	300	59554.33	63886 <sub>3/2</sub> — 123440° <sub>3/2</sub>
1543.172	20	64801.59	80552 <sub>5/2</sub> — 145353° <sub>3/2</sub>	1681.462	150	59472.05	68963 <sub>5/2</sub> — 128435° <sub>3/2</sub>
1543.366	100	64793.44	63886 <sub>3/2</sub> — 128679° <sub>5/2</sub>	1682.034	50	59451.83	80305 <sub>3/2</sub> — 139757° <sub>5/2</sub>
1543.455	200	64789.71	89018 <sub>9/2</sub> — 153808° <sub>9/2</sub>	1682.680	100	59429.01	85447 <sub>3/2</sub> — 144876° <sub>3/2</sub>
1544.056	15	64764.49	62065 <sub>7/2</sub> — 126829° <sub>7/2</sub>	1684.624	250	59360.43	63143 <sub>5/2</sub> — 122504° <sub>7/2</sub>
1544.132	50	64761.30	89046 <sub>7/2</sub> — 153808° <sub>9/2</sub>	1686.194	200	59305.16	78780 <sub>3/2</sub> — 138084° <sub>5/2</sub>
1548.877	150	64562.91	89046 <sub>7/2</sub> — 153609° <sub>7/2</sub>	1687.115	300	59272.78	62065 <sub>7/2</sub> — 121337° <sub>9/2</sub>
1549.215	50	64548.82	63886 <sub>3/2</sub> — 128435° <sub>3/2</sub>	1688.609	50	59220.34	86133 <sub>1/2</sub> — 145353° <sub>3/2</sub>
1549.306	2	64545.03	77968 <sub>5/2</sub> — 142513° <sub>3/2</sub>	1689.032	100	59205.51	80552 <sub>5/2</sub> — 139757° <sub>5/2</sub>
1554.617	20	64324.52	80552 <sub>5/2</sub> — 144876° <sub>3/2</sub>	1692.686	200	59077.70	67016 <sub>7/2</sub> — 126094° <sub>7/2</sub>
1561.793	100	64028.97	62065 <sub>7/2</sub> — 126094° <sub>7/2</sub>	1696.183	75	58955.90	80305 <sub>3/2</sub> — 139261° <sub>1/2</sub>
1565.202	125	63889.52	80305 <sub>3/2</sub> — 144195° <sub>5/2</sub>	1699.574	3	58838.27	80423 <sub>1/2</sub> — 139261° <sub>1/2</sub>
1568.118	5	63770.71	78780 <sub>3/2</sub> — 142550° <sub>1/2</sub>	1701.011	200	58788.57	89018 <sub>9/2</sub> — 147806° <sub>7/2</sub>
1568.567	50	63752.46	60805 <sub>9/2</sub> — 124557° <sub>7/2</sub>	1702.104	400	58750.82	63886 <sub>3/2</sub> — 122637° <sub>1/2</sub>
1568.669	40	63748.31	63143 <sub>5/2</sub> — 126892° <sub>5/2</sub>	1702.183	300	58748.09	85447 <sub>3/2</sub> — 144195° <sub>5/2</sub>
1569.044	40	63733.07	78780 <sub>3/2</sub> — 142513° <sub>3/2</sub>	1702.334	35	58742.88	86133 <sub>1/2</sub> — 144876° <sub>3/2</sub>
1570.204	200	63685.99	63143 <sub>5/2</sub> — 126829° <sub>7/2</sub>	1702.971	300	58720.91	63143 <sub>5/2</sub> — 121864° <sub>3/2</sub>
1570.975	1	63654.74	124442° <sub>9/2</sub> — 188097 <sub>9/2</sub>	1704.061	30	58683.34	80305 <sub>3/2</sub> — 138989° <sub>3/2</sub>
1571.166	75	63647.00	138084° <sub>5/2</sub> — 201732 <sub>3/2</sub>	1705.319	150	58640.05	77968 <sub>5/2</sub> — 136607° <sub>5/2</sub>
			78780 <sub>3/2</sub> — 142427° <sub>5/2</sub>	1705.620	200	58629.71	89018 <sub>9/2</sub> — 147647° <sub>11/2</sub>
1571.265	20	63642.99	80552 <sub>5/2</sub> — 144195° <sub>5/2</sub>	1707.483	20	58565.74	80423 <sub>1/2</sub> — 138989° <sub>3/2</sub>
1571.402	40	63637.44	60805 <sub>9/2</sub> — 124442° <sub>9/2</sub>	1708.935	100	58515.98	77968 <sub>5/2</sub> — 136483° <sub>3/2</sub>
1579.361	75	63316.75	62065 <sub>7/2</sub> — 125382° <sub>5/2</sub>	1709.026	300	58512.86	62065 <sub>7/2</sub> — 120577° <sub>5/2</sub>
1581.863	1	63216.60	85447 <sub>3/2</sub> — 148663° <sub>5/2</sub>	1711.245	75	58436.99	80552 <sub>5/2</sub> — 138989° <sub>3/2</sub>
1588.554	75	62950.33	63143 <sub>5/2</sub> — 126094° <sub>7/2</sub>	1711.423	100	58430.91	80552 <sub>5/2</sub> — 138982° <sub>7/2</sub>
1593.748	500r	62745.18	60805 <sub>9/2</sub> — 123550° <sub>9/2</sub>	1713.336	30	58365.67	67016 <sub>7/2</sub> — 125382° <sub>5/2</sub>
1597.425	50	62600.75	63143 <sub>5/2</sub> — 125744° <sub>3/2</sub>	1716.390	100	58261.82	78780 <sub>3/2</sub> — 137041° <sub>1/2</sub>
1600.185	400	62492.77	62065 <sub>7/2</sub> — 124557° <sub>7/2</sub>	1722.369	500	58059.57	60805 <sub>9/2</sub> — 118864° <sub>7/2</sub>
1603.134	300	62377.82	62065 <sub>7/2</sub> — 124442° <sub>9/2</sub>	1724.795	75	57977.90	63886 <sub>3/2</sub> — 121864° <sub>3/2</sub>
1605.960	200	62268.05	80552 <sub>5/2</sub> — 142820° <sub>7/2</sub>	1726.265	30	57928.53	68963 <sub>5/2</sub> — 126892° <sub>5/2</sub>
1606.557	20	62244.91	80305 <sub>3/2</sub> — 142550° <sub>1/2</sub>	1728.125	150	57866.18	68963 <sub>5/2</sub> — 126829° <sub>7/2</sub>
1606.723	300	62238.48	63143 <sub>5/2</sub> — 125382° <sub>5/2</sub>	1730.724	5	57779.29	80305 <sub>3/2</sub> — 138084° <sub>5/2</sub>
1606.850	40	62233.56	77968 <sub>5/2</sub> — 140201° <sub>3/2</sub>	1732.988	50	57703.80	78780 <sub>3/2</sub> — 136483° <sub>3/2</sub>
1607.524	100	62207.47	80305 <sub>3/2</sub> — 142513° <sub>3/2</sub>	1737.888	100	57541.11	67016 <sub>7/2</sub> — 124557° <sub>7/2</sub>
1607.559	100	62206.11	85447 <sub>3/2</sub> — 147653° <sub>1/2</sub>	1738.142	100	57532.70	80552 <sub>5/2</sub> — 138084° <sub>5/2</sub>
1609.597	100	62127.35	80423 <sub>1/2</sub> — 142550° <sub>1/2</sub>	1738.646	75	57516.02	89018 <sub>9/2</sub> — 146534° <sub>9/2</sub>
1609.748	200	62121.52	80305 <sub>3/2</sub> — 142427° <sub>5/2</sub>	1739.505	300	57487.62	89046 <sub>7/2</sub> — 146534° <sub>9/2</sub>
1610.570	150	62089.82	80423 <sub>1/2</sub> — 142513° <sub>3/2</sub>	1741.131	75	57433.93	63143 <sub>5/2</sub> — 120577° <sub>5/2</sub>
1616.161	50	61875.02	80552 <sub>5/2</sub> — 142427° <sub>5/2</sub>	1741.368	600	57426.12	67016 <sub>7/2</sub> — 124442° <sub>9/2</sub>
1616.605	200	61858.03	63886 <sub>3/2</sub> — 125744° <sub>3/2</sub>	1750.386	400	57130.26	68963 <sub>5/2</sub> — 126094° <sub>7/2</sub>
1618.406	50	61789.19	77968 <sub>5/2</sub> — 139757° <sub>5/2</sub>	1755.006	100	56979.86	85447 <sub>3/2</sub> — 142427° <sub>5/2</sub>
1620.774	15	61698.92	60805 <sub>9/2</sub> — 122504° <sub>7/2</sub>	1760.580	75	56799.46	62065 <sub>7/2</sub> — 118864° <sub>7/2</sub>
1621.718	40	61663.00	67016 <sub>7/2</sub> — 128679° <sub>5/2</sub>	1761.155	75	56780.92	68963 <sub>5/2</sub> — 125744° <sub>3/2</sub>
				1762.555	100	56735.82	80305 <sub>3/2</sub> — 137041° <sub>1/2</sub>

TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (vac)	Inten- sity	Wavenumber	Transition	$\lambda$ (vac)	Inten- sity	Wavenumber	Transition
1763.948	1	56691.01	63886 $3/2$ — 120577° $5/2$	1873.343	0	53380.51	89046 $7/2$ — 142427° $5/2$
1766.221	50	56618.06	80423 $1/2$ — 137041° $1/2$	1882.252	40	53127.85	86133 $1/2$ — 139261° $1/2$
1768.861	200	56533.55	67016 $7/2$ — 123550° $9/2$	1889.888	2	52913.19	142427° $5/2$ — 195340 $5/2$
1772.299	2	56423.89	67016 $7/2$ — 123440° $5/2$	1890.340	20	52900.54	68963 $5/2$ — 121864° $3/2$
1772.483	50	56418.03	68963 $5/2$ — 125382° $5/2$	1891.960	2	52855.24	86133 $1/2$ — 138989° $3/2$
1773.697	20	56379.41	86133 $1/2$ — 142513° $3/2$	1904.024	2	52520.35	142820° $7/2$ — 195340 $5/2$
1776.129	75	56302.22	80305 $3/2$ — 136607° $5/2$	1913.644	2	52256.32	142427° $5/2$ — 194683 $3/2$
1780.059	30	56177.91	80305 $3/2$ — 136483° $3/2$	1928.714	75	51848.02	67016 $7/2$ — 118864° $7/2$
1783.792	75	56060.35	80423 $1/2$ — 136483° $3/2$	1937.462	50	51613.91	68963 $5/2$ — 120577° $5/2$
1783.941	30	56055.67	80552 $5/2$ — 136607° $5/2$	1954.630	20	51160.58	85447 $3/2$ — 136607° $5/2$
1787.902	10	55931.48	80552 $5/2$ — 136483° $3/2$	1958.282	10	51065.17	142820° $7/2$ — 193885 $5/2$
1798.757	30	55593.95	68963 $5/2$ — 124557° $7/2$	1959.386	30	51036.40	85447 $3/2$ — 136483° $3/2$
1826.339	100	54754.35	85447 $3/2$ — 140201° $3/2$	1964.335	20	50907.81	86133 $1/2$ — 137041° $1/2$
1835.643	2	54476.82	68963 $5/2$ — 123440° $5/2$	1968.026	3	50812.34	
1840.913	200	54320.87	67016 $7/2$ — 121337° $9/2$	1971.948	100	50711.28	77968 $5/2$ — 128679° $5/2$
1849.525	15	54067.94	86133 $1/2$ — 140201° $3/2$	1972.370	3	50700.43	142820° $7/2$ — 193520 $7/2$
1858.251	5	53814.04	85447 $3/2$ — 139261° $1/2$	1978.211	3	50550.72	142820° $7/2$ — 193370 $9/2$
1858.678	20	53801.68	89018 $9/2$ — 142820° $7/2$	1981.478	20	50467.38	77968 $5/2$ — 128435° $3/2$
1867.023	2	53561.20	67016 $7/2$ — 120577° $5/2$	1986.104	3	50349.83	86133 $1/2$ — 136483° $3/2$
1867.747	100	53540.44	68963 $5/2$ — 122504° $7/2$				

TABLE 1. *Observed lines of CuIII*—Continued

$\lambda$ (air)	Intensity	Wavenumber	Transition	$\lambda$ (air)	Intensity	Wavenumber	Transition
2000.781	50	49964.30	89018 $\frac{9}{2}$ – 138982° $\frac{7}{2}$	2405.505	800	41558.67	80305 $\frac{3}{2}$ – 121864° $\frac{3}{2}$
2001.917	2	49935.95	89046 $\frac{7}{2}$ – 138982° $\frac{7}{2}$	2408.381	10	41509.04	220311 $\frac{11}{2}$ – 261820° $\frac{11}{2}$
2003.367	1	49899.81	78780 $\frac{3}{2}$ – 128679° $\frac{3}{2}$	2409.414	0	41491.25	196100 $\frac{3}{2}$ – 237591° $\frac{1}{2}$
2013.225	200	49655.50	78780 $\frac{3}{2}$ – 128435° $\frac{3}{2}$	2409.572	3	41488.53	195061 $\frac{9}{2}$ – 236550° $\frac{9}{2}$
2038.577	50	49038.07	89046 $\frac{7}{2}$ – 138084° $\frac{5}{2}$	2409.947	1	41482.07	
2043.326	100	48924.11	77968 $\frac{5}{2}$ – 126892° $\frac{5}{2}$	2410.645	3	41470.06	195061 $\frac{9}{2}$ – 236531° $\frac{11}{2}$
2077.046	75	48129.95	80305 $\frac{3}{2}$ – 128435° $\frac{3}{2}$	2412.107	400	41444.93	85447 $\frac{3}{2}$ – 126892° $\frac{5}{2}$
2077.141	20	48127.75	80552 $\frac{5}{2}$ – 128679° $\frac{5}{2}$	2412.338	700	41440.96	80423 $\frac{1}{2}$ – 121864° $\frac{3}{2}$
2077.813	5	48112.19	78780 $\frac{3}{2}$ – 126892° $\frac{5}{2}$	2413.188	2	41426.37	220569 $\frac{7}{2}$ – 261995° $\frac{9}{2}$
2083.452	2	47981.99	147806° $\frac{7}{2}$ – 195788° $\frac{7}{2}$	2417.243	5	41356.88	195061 $\frac{9}{2}$ – 236418° $\frac{11}{2}$
2087.742	15	47883.40	80552 $\frac{5}{2}$ – 128435° $\frac{3}{2}$	2419.858	30	41312.19	80552 $\frac{5}{2}$ – 121864° $\frac{3}{2}$
2092.408	15	47776.64	77968 $\frac{5}{2}$ – 125744° $\frac{3}{2}$	2420.033	15	41309.20	
2108.420	30	47413.85	77968 $\frac{5}{2}$ – 125382° $\frac{5}{2}$	2420.088	3	41308.26	
2112.314	15	47326.46	211821° $\frac{7}{2}$ – 259147° $\frac{9}{2}$ ?	2421.836	150	41278.45	212752 $\frac{7}{2}$ – 254030° $\frac{9}{2}$
2113.741	10	47294.51	118864° $\frac{7}{2}$ – 166159° $\frac{9}{2}$	2422.266	0	41271.12	195340 $\frac{5}{2}$ – 236611° $\frac{7}{2}$
2119.715	5	47161.24	120577° $\frac{5}{2}$ – 167739° $\frac{7}{2}$	2423.070	2	41257.43	213514 $\frac{5}{2}$ – 254772° $\frac{7}{2}$
2128.577	30	46964.91	78780 $\frac{3}{2}$ – 125744° $\frac{3}{2}$	2423.502	1	41250.07	195340 $\frac{5}{2}$ – 236590° $\frac{3}{2}$
2145.727	5	46589.58	77968 $\frac{5}{2}$ – 124557° $\frac{7}{2}$	2426.058	0	41206.62	195343 $\frac{7}{2}$ – 266550° $\frac{9}{2}$
2154.435	3	46401.29	121337° $\frac{9}{2}$ – 167739° $\frac{7}{2}$	2428.151	75	41171.10	195340 $\frac{5}{2}$ – 236511° $\frac{7}{2}$
2156.677	2	46353.06	122504° $\frac{7}{2}$ – 168856° $\frac{5}{2}$	2430.345	200	41133.94	193520 $\frac{7}{2}$ – 234654° $\frac{9}{2}$
2157.277	150	46340.17	80552 $\frac{5}{2}$ – 126892° $\frac{5}{2}$	2430.528	100	41130.84	195340 $\frac{5}{2}$ – 236471° $\frac{5}{2}$
2186.448	2	45721.98		2431.728	3	41110.55	
2217.768	3	45076.34	80305 $\frac{3}{2}$ – 125382° $\frac{5}{2}$	2432.755	0	41093.19	195518 $\frac{9}{2}$ – 236611° $\frac{7}{2}$ ?
2244.680	1	44535.96	77968 $\frac{5}{2}$ – 122504° $\frac{7}{2}$	2433.499	3	41080.63	
2248.491	6	44460.49	121699° $\frac{11}{2}$ – 166159° $\frac{9}{2}$	2434.004	2	41072.11	196742 $\frac{7}{2}$ – 237814° $\frac{7}{2}$
2271.728	25	44005.75	80552 $\frac{5}{2}$ – 124557° $\frac{7}{2}$	2434.370	15	41065.93	
2277.395	40	43896.26	77968 $\frac{5}{2}$ – 121864° $\frac{3}{2}$	2435.048	15	41054.50	195340 $\frac{5}{2}$ – 236395° $\frac{5}{2}$
2279.102	10	43863.39	125744° $\frac{3}{2}$ – 169608° $\frac{3}{2}$	2435.824	300	41041.42	193520 $\frac{7}{2}$ – 234562° $\frac{7}{2}$
2279.416	15	43857.34	78780 $\frac{3}{2}$ – 122637° $\frac{1}{2}$	2436.107	3	41036.65	196742 $\frac{7}{2}$ – 237778° $\frac{9}{2}$
2299.473	100	43474.84	125382° $\frac{5}{2}$ – 168856° $\frac{5}{2}$	2436.388	10	41031.92	195518 $\frac{9}{2}$ – 236550° $\frac{9}{2}$
2312.353	12	43232.70	85447 $\frac{3}{2}$ – 128679° $\frac{5}{2}$	2436.843	5	41024.26	196806 $\frac{3}{2}$ – 237830° $\frac{5}{2}$
2315.103	20	43181.35	124557° $\frac{7}{2}$ – 167739° $\frac{7}{2}$	2437.168	10	41018.79	195518 $\frac{9}{2}$ – 236537° $\frac{9}{2}$
2318.815	0	43112.23	125744° $\frac{3}{2}$ – 168856° $\frac{5}{2}$	2437.482	4	41013.51	195518 $\frac{9}{2}$ – 236531° $\frac{11}{2}$
2320.306	100	43084.53	78780 $\frac{3}{2}$ – 121864° $\frac{3}{2}$	2437.774	3	41008.59	196742 $\frac{7}{2}$ – 237751° $\frac{7}{2}$
2323.268	2	43029.60	193520 $\frac{7}{2}$ – 236550° $\frac{9}{2}$	2438.130	2	41002.61	
2323.972	2	43016.57	193520 $\frac{7}{2}$ – 236537° $\frac{9}{2}$	2438.356	10	40998.81	213127 $\frac{3}{2}$ – 254125° $\frac{5}{2}$ ?
2325.370	5	42990.71	194683 $\frac{3}{2}$ – 237674° $\frac{5}{2}$	2439.269	20	40983.46	196795 $\frac{9}{2}$ – 237778° $\frac{9}{2}$
			193520 $\frac{7}{2}$ – 236511° $\frac{7}{2}$	2440.072	200	40969.98	193520 $\frac{7}{2}$ – 234490° $\frac{5}{2}$
2325.499	3	42988.33	85447 $\frac{3}{2}$ – 128435° $\frac{3}{2}$	2440.884	5	40956.35	195555 $\frac{5}{2}$ – 236511° $\frac{7}{2}$
2345.253	3	42626.27	193885 $\frac{5}{2}$ – 236511° $\frac{7}{2}$	2441.933	15	40938.75	148663° $\frac{3}{2}$ – 189602° $\frac{7}{2}$
2346.159	200	42609.81	77968 $\frac{5}{2}$ – 120577° $\frac{5}{2}$	2442.582	125	40927.88	196806 $\frac{3}{2}$ – 237734° $\frac{5}{2}$
2346.198	200	42609.10	123550° $\frac{9}{2}$ – 166159° $\frac{9}{2}$	2443.701	20	40909.14	126829° $\frac{7}{2}$ – 167739° $\frac{7}{2}$
2346.774	10	42598.64		2444.122	10	40902.09	196742 $\frac{7}{2}$ – 237644° $\frac{9}{2}$
2347.470	3	42586.01	193885 $\frac{5}{2}$ – 236471° $\frac{5}{2}$	2444.233	250	40900.23	195518 $\frac{9}{2}$ – 236418° $\frac{11}{2}$
2353.652	10	42474.17	195340 $\frac{5}{2}$ – 237814° $\frac{7}{2}$	2444.439	2000	40896.79	77968 $\frac{5}{2}$ – 118864° $\frac{7}{2}$
2354.848	10	42452.60	211679 $\frac{5}{2}$ – 254132° $\frac{7}{2}$	2444.864	5	40889.68	193885 $\frac{5}{2}$ – 234775° $\frac{5}{2}$
2357.160	1	42410.96	195340 $\frac{5}{2}$ – 237751° $\frac{7}{2}$	2445.942	2	40871.66	
2358.775	3	42381.93		2446.164	15	40867.95	196806 $\frac{3}{2}$ – 237674° $\frac{5}{2}$ ?
2360.162	20	42357.02	125382° $\frac{5}{2}$ – 167739° $\frac{7}{2}$	2446.743	250	40858.28	220311 $\frac{11}{2}$ – 261169° $\frac{13}{2}$
2361.586	200	42331.48	80305 $\frac{3}{2}$ – 122637° $\frac{1}{2}$	2447.508	200	40845.51	196795 $\frac{9}{2}$ – 237641° $\frac{11}{2}$
2363.234	100	42301.96	86133 $\frac{1}{2}$ – 128435° $\frac{3}{2}$	2449.424	10	40813.56	213312 $\frac{3}{2}$ – 254125° $\frac{5}{2}$
2367.915	1	42218.35		2450.694	1	40792.41	195757 $\frac{11}{2}$ – 236550° $\frac{9}{2}$
2368.174	500	42213.73	80423 $\frac{1}{2}$ – 122637° $\frac{1}{2}$	2451.137	1	40785.04	196806 $\frac{3}{2}$ – 237591° $\frac{1}{2}$
2377.788	5	42043.06		2451.722	3	40775.31	193885 $\frac{5}{2}$ – 234660° $\frac{3}{2}$
2379.591	5	42011.21	195722 $\frac{1}{2}$ – 237734° $\frac{3}{2}$	2451.805	50	40773.93	195757 $\frac{11}{2}$ – 236531° $\frac{11}{2}$
2380.855	3	41988.91		2452.513	25	40762.16	195722 $\frac{1}{2}$ – 236484° $\frac{3}{2}$
2382.033	10	41968.15		2452.668	5	40759.58	197055 $\frac{7}{2}$ – 237814° $\frac{7}{2}$ ?
2382.952	5	41951.96	80552 $\frac{5}{2}$ – 122504° $\frac{7}{2}$				210239 $\frac{7}{2}$ – 250999° $\frac{9}{2}$ ?
2383.070	2	41949.88	153808° $\frac{9}{2}$ – 195757° $\frac{11}{2}$	2452.980	300	40754.40	220413 $\frac{13}{2}$ – 261167° $\frac{13}{2}$
2385.408	0	41908.77	153609° $\frac{7}{2}$ – 195518° $\frac{9}{2}$	2453.758	8	40741.48	194033 $\frac{11}{2}$ – 234774° $\frac{9}{2}$
2385.522	1	41906.77	194683 $\frac{3}{2}$ – 236590° $\frac{5}{2}$	2454.312	5	40732.28	196806 $\frac{3}{2}$ – 237538° $\frac{3}{2}$
2387.693	5	41868.67	195722 $\frac{1}{2}$ – 237591° $\frac{1}{2}$	2454.819	5	40723.87	197055 $\frac{7}{2}$ – 237778° $\frac{9}{2}$
2390.709	10	41815.85	195722 $\frac{1}{2}$ – 237538° $\frac{3}{2}$	2456.499	3	40696.02	197055 $\frac{7}{2}$ – 237751° $\frac{7}{2}$
2391.739	400	41797.85	78780 $\frac{3}{2}$ – 120577° $\frac{5}{2}$	2457.661	30	40676.78	193885 $\frac{5}{2}$ – 234562° $\frac{7}{2}$
2392.324	2	41787.63	194683 $\frac{3}{2}$ – 236471° $\frac{5}{2}$	2458.691	400	40659.74	195757 $\frac{11}{2}$ – 236417° $\frac{13}{2}$
2394.463	1	41750.30	196028 $\frac{9}{2}$ – 237778° $\frac{9}{2}$	2459.396	250	40648.09	195722 $\frac{1}{2}$ – 236370° $\frac{1}{2}$
2396.405	10	41716.47	124442° $\frac{9}{2}$ – 166159° $\frac{9}{2}$				194033 $\frac{11}{2}$ – 234681° $\frac{11}{2}$
2396.575	0	41713.51	194818 $\frac{11}{2}$ – 236531° $\frac{11}{2}$	2460.302	15	40633.12	213815 $\frac{7}{2}$ – 254448° $\frac{9}{2}$
2396.698	10	41711.37	194683 $\frac{3}{2}$ – 236395° $\frac{3}{2}$	2461.981	200	40605.41	193885 $\frac{5}{2}$ – 234490° $\frac{5}{2}$
2400.803	15	41640.05	194683 $\frac{3}{2}$ – 236323° $\frac{1}{2}$	2462.248	2	40601.01	195722 $\frac{1}{2}$ – 236323° $\frac{1}{2}$
2402.401	10	41612.36	196028 $\frac{9}{2}$ – 237641° $\frac{11}{2}$	2462.954	100	40589.37	197055 $\frac{7}{2}$ – 237644° $\frac{9}{2}$
2403.046	10	41601.19	124557° $\frac{7}{2}$ – 166159° $\frac{9}{2}$	2463.059	10	40587.64	
2404.606	10	41574.20	196100 $\frac{3}{2}$ – 237674° $\frac{5}{2}$				

TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (air)	Intensity	Wavenumber	Transition	$\lambda$ (air)	Intensity	Wavenumber	Transition
2463.657	5	40577.79	210239 $\frac{7}{2}$ –250817° $\frac{7}{2}$	2515.063	10	39748.47	197985 $\frac{3}{2}$ –237734° $\frac{3}{2}$
2463.860	150	40574.45	210159 $\frac{5}{2}$ –250733° $\frac{7}{2}$	2515.492	3	39741.69	196795 $\frac{9}{2}$ –236537° $\frac{9}{2}$
2465.848	100	40541.74	193885 $\frac{5}{2}$ –234427° $\frac{3}{2}$	2515.568	5	39740.49	196730 $\frac{5}{2}$ –236471° $\frac{5}{2}$
2466.297	3	40534.36	197199 $\frac{1}{2}$ –237734° $\frac{3}{2}$	2515.829	5	39736.37	196795 $\frac{9}{2}$ –236531° $\frac{11}{2}$
2467.873	25	40508.48	196028 $\frac{9}{2}$ –236537° $\frac{9}{2}$	2516.331	250	39728.44	211271 $\frac{7}{2}$ –250999° $\frac{9}{2}$
2468.191	50	40503.26	196028 $\frac{9}{2}$ –236531° $\frac{11}{2}$	2516.736	3	39722.05	
2468.411	500	40499.65	194033 $\frac{11}{2}$ –234532° $\frac{13}{2}$	2516.866	250	39720.00	214747 $\frac{9}{2}$ –254467° $\frac{11}{2}$
2468.725	300	40494.50	210239 $\frac{7}{2}$ –250734° $\frac{9}{2}$	2517.214	3	39714.51	194818 $\frac{11}{2}$ –234532° $\frac{13}{2}$
2468.777	10	40493.64	210239 $\frac{7}{2}$ –250733° $\frac{7}{2}$	2517.321	100	39712.82	195061 $\frac{9}{2}$ –234774° $\frac{9}{2}$
2468.987	50	40490.20	196100 $\frac{3}{2}$ –236590° $\frac{5}{2}$	2517.687	15	39707.05	
2469.433	1	40482.89	196028 $\frac{9}{2}$ –236511° $\frac{7}{2}$	2518.112	15	39700.34	198033 $\frac{1}{2}$ –237734° $\frac{3}{2}$
2471.454	1	40449.78	147647° $\frac{11}{2}$ –188097 $\frac{9}{2}$	2518.324	300	39697.00	211313 $\frac{9}{2}$ –251010° $\frac{11}{2}$
2474.503	3	40399.95		2518.777	300	39689.86	198061 $\frac{5}{2}$ –237751° $\frac{7}{2}$
2475.116	200	40389.94	196028 $\frac{9}{2}$ –236418° $\frac{11}{2}$	2518.846	75	39688.78	197985 $\frac{3}{2}$ –237674° $\frac{5}{2}$
2475.428	50	40384.85	194331 $\frac{13}{2}$ –234716° $\frac{11}{2}$	2519.488	5	39678.66	196806 $\frac{3}{2}$ –236484° $\frac{3}{2}$
			196100 $\frac{3}{2}$ –236484° $\frac{3}{2}$	2519.863	0	39672.76	198061 $\frac{5}{2}$ –237734° $\frac{3}{2}$
2477.593	1	40349.57	194331 $\frac{13}{2}$ –234681° $\frac{11}{2}$	2519.917	5	39671.91	215100 $\frac{5}{2}$ –254772° $\frac{7}{2}$
2478.236	400	40339.10	194331 $\frac{13}{2}$ –234670° $\frac{13}{2}$	2520.363	35	39664.89	196806 $\frac{3}{2}$ –236471° $\frac{5}{2}$
			197199 $\frac{1}{2}$ –237538° $\frac{3}{2}$	2520.995	200	39654.95	195061 $\frac{9}{2}$ –234716° $\frac{11}{2}$
2479.629	2	40316.44	213815 $\frac{7}{2}$ –254132° $\frac{7}{2}$	2522.385	500	39633.09	89046 $\frac{7}{2}$ –128679° $\frac{5}{2}$
2480.957	5	40294.86	196100 $\frac{3}{2}$ –236395° $\frac{3}{2}$	2523.022	350	39623.09	196795 $\frac{9}{2}$ –236418° $\frac{11}{2}$
2481.196	15	40290.98	147806° $\frac{7}{2}$ –188097 $\frac{9}{2}$	2523.254	250	39619.45	195061 $\frac{9}{2}$ –234681° $\frac{11}{2}$
2482.357	1000	40272.13	80305 $\frac{3}{2}$ –120577° $\frac{5}{2}$	2523.654	50	39613.17	198061 $\frac{5}{2}$ –237674° $\frac{5}{2}$
2482.782	10	40265.24	197375 $\frac{9}{2}$ –237641° $\frac{11}{2}$	2523.774	5	39611.28	86133 $\frac{1}{2}$ –125744° $\frac{3}{2}$
2485.267	3	40224.98	153808° $\frac{9}{2}$ –194033 $\frac{11}{2}$ ?	2523.977	15	39608.10	211123 $\frac{3}{2}$ –250731° $\frac{5}{2}$
2485.358	15	40223.51	196100 $\frac{3}{2}$ –236323° $\frac{1}{2}$	2524.243	25	39603.92	214844° $\frac{7}{2}$ –254448° $\frac{9}{2}$
2486.463	700	40205.64	194331 $\frac{13}{2}$ –234537° $\frac{15}{2}$	2524.950	100d	39592.84	195061 $\frac{9}{2}$ –234654° $\frac{9}{2}$
2486.741	3	40201.14	194331 $\frac{13}{2}$ –234532° $\frac{13}{2}$	2525.213	25	39588.71	196806 $\frac{3}{2}$ –236395° $\frac{3}{2}$
2487.721	35	40185.31	197593 $\frac{7}{2}$ –237778° $\frac{9}{2}$	2526.755	10	39564.55	196806 $\frac{3}{2}$ –236370° $\frac{1}{2}$
2488.231	3	40177.07	128679° $\frac{5}{2}$ –168856° $\frac{5}{2}$	2527.189	35	39557.76	198033 $\frac{1}{2}$ –237591° $\frac{1}{2}$
2489.449	25	40157.41		2527.495	10	39552.97	197985 $\frac{3}{2}$ –237538° $\frac{3}{2}$
2490.972	3	40132.86		2527.913	3	39546.43	211271 $\frac{7}{2}$ –250817° $\frac{7}{2}$
2493.552	25	40091.34	194683 $\frac{3}{2}$ –234775° $\frac{5}{2}$	2528.552	3	39536.44	
2494.148	3	40081.76	214844 $\frac{7}{2}$ –254926° $\frac{7}{2}$	2529.768	10	39517.44	196806 $\frac{3}{2}$ –236323° $\frac{1}{2}$
2494.193	2	40081.04	197593 $\frac{7}{2}$ –237674° $\frac{5}{2}$	2530.122	1	39511.91	197038 $\frac{11}{2}$ –236550° $\frac{9}{2}$
2495.563	2	40059.04		2530.570	5	39504.91	198033 $\frac{1}{2}$ –237538° $\frac{3}{2}$
2496.078	350	40050.77	197593 $\frac{7}{2}$ –237644° $\frac{9}{2}$	2530.868	50	39500.26	195061 $\frac{9}{2}$ –234562° $\frac{7}{2}$
2496.962	2	40036.60	214747 $\frac{9}{2}$ –254448° $\frac{9}{2}$	2531.188	10	39495.27	197055 $\frac{7}{2}$ –236550° $\frac{9}{2}$
2497.638	400	40025.76	80552 $\frac{5}{2}$ –120577° $\frac{5}{2}$	2531.314	50	39493.30	197038 $\frac{11}{2}$ –236531° $\frac{11}{2}$
2497.867	10	40022.09		2532.038	250	39482.01	197055 $\frac{7}{2}$ –236537° $\frac{9}{2}$
2500.656	100	39976.82	194683 $\frac{3}{2}$ –234660° $\frac{3}{2}$	2532.341	2	39477.29	198061 $\frac{5}{2}$ –237538° $\frac{3}{2}$
2501.638	10	39961.76		2532.648	25	39472.50	195340 $\frac{5}{2}$ –234812° $\frac{7}{2}$
2501.975	1	39956.38	194818 $\frac{11}{2}$ –234774° $\frac{9}{2}$	2532.863	250	39469.15	195343 $\frac{7}{2}$ –234812° $\frac{7}{2}$
2503.029	75	39939.56	214844 $\frac{7}{2}$ –254784° $\frac{9}{2}$	2533.249	3	39463.14	211271 $\frac{7}{2}$ –250734° $\frac{9}{2}$
2503.180	5	39937.15	214989 $\frac{5}{2}$ –254926° $\frac{7}{2}$	2533.308	5	39462.22	211271 $\frac{7}{2}$ –250733° $\frac{3}{2}$
2503.327	2	39934.80	85447 $\frac{3}{2}$ –125382° $\frac{5}{2}$	2533.686	200	39456.33	197055 $\frac{7}{2}$ –236511° $\frac{7}{2}$
2503.625	75	39930.05	197900 $\frac{5}{2}$ –237830° $\frac{5}{2}$	2535.083	25	39434.59	195340 $\frac{5}{2}$ –234775° $\frac{5}{2}$
2504.629	150	39914.05	197900 $\frac{5}{2}$ –237814° $\frac{7}{2}$	2535.316	400	39430.97	195343 $\frac{7}{2}$ –234774° $\frac{9}{2}$
2505.609	200	39898.44	194818 $\frac{11}{2}$ –234716° $\frac{11}{2}$	2535.965	10	39420.88	211313 $\frac{9}{2}$ –250734° $\frac{9}{2}$
2505.762	10	39896.00	221861 $\frac{7}{2}$ –261757° $\frac{9}{2}$	2536.270	10	39416.14	197055 $\frac{7}{2}$ –236471° $\frac{5}{2}$
2506.527	10	39883.82	221878 $\frac{5}{2}$ –261762° $\frac{7}{2}$	2538.659	500	39379.05	197038 $\frac{11}{2}$ –236417° $\frac{13}{2}$
2506.720	125	39880.75	196730 $\frac{5}{2}$ –236611° $\frac{7}{2}$	2540.045	10	39357.56	189602 $\frac{7}{2}$ –228960° $\frac{5}{2}$
2507.452	150	39869.11	196742 $\frac{7}{2}$ –236611° $\frac{7}{2}$	2540.153	2	39355.89	
2507.832	5	39863.07	194818 $\frac{11}{2}$ –234681° $\frac{11}{2}$	2540.446	5	39351.35	
2508.052	125	39859.57	196730 $\frac{5}{2}$ –236590° $\frac{5}{2}$	2543.557	25	39303.22	211652 $\frac{3}{2}$ –250955° $\frac{5}{2}$ ?
2508.488	500	39852.65	194818 $\frac{11}{2}$ –234670° $\frac{7}{2}$	2543.738	3	39300.42	
2508.612	75	39850.68	197900 $\frac{5}{2}$ –237751° $\frac{13}{2}$	2546.596	50	39256.32	195518 $\frac{9}{2}$ –234774° $\frac{9}{2}$
2508.775	5	39848.09	196742 $\frac{7}{2}$ –236390° $\frac{5}{2}$	2547.008	3	39249.97	
2508.848	50	39846.93	194683 $\frac{3}{2}$ –234530° $\frac{1}{2}$	2547.938	3	39235.65	197375 $\frac{9}{2}$ –236611° $\frac{7}{2}$
2508.965	15	39845.07	197985 $\frac{3}{2}$ –237830° $\frac{5}{2}$	2548.841	10	39221.75	195340 $\frac{5}{2}$ –234562° $\frac{7}{2}$
2509.515	15	39836.34	194818 $\frac{11}{2}$ –234654° $\frac{9}{2}$	2549.071	2	39218.21	195343 $\frac{7}{2}$ –234562° $\frac{7}{2}$
2509.687	3	39833.61	197900 $\frac{5}{2}$ –237734° $\frac{5}{2}$	2549.185	5	39216.45	
2510.802	2	39815.92	196795 $\frac{9}{2}$ –236611° $\frac{7}{2}$	2549.519	2	39211.32	197400 $\frac{5}{2}$ –236611° $\frac{7}{2}$
2511.297	200	39808.07	196742 $\frac{7}{2}$ –236550° $\frac{9}{2}$	2550.359	200	39198.40	195518 $\frac{9}{2}$ –234716° $\frac{11}{2}$
2512.137	15?	39794.76	196742 $\frac{7}{2}$ –236537° $\frac{9}{2}$	2550.889	1	39190.26	197400 $\frac{5}{2}$ –236590° $\frac{5}{2}$
2512.815	2	39784.03	196806 $\frac{3}{2}$ –236590° $\frac{5}{2}$	2551.910	100	39174.58	197375 $\frac{9}{2}$ –236550° $\frac{9}{2}$
2512.896	35	39782.74	214989 $\frac{5}{2}$ –254772° $\frac{7}{2}$	2552.122	5	39171.33	197199 $\frac{1}{2}$ –236370° $\frac{1}{2}$
2513.023	50	39780.73	196730 $\frac{5}{2}$ –236511° $\frac{7}{2}$	2552.671	200	39162.90	195518 $\frac{9}{2}$ –234681° $\frac{11}{2}$
2513.748	8	39769.26	196742 $\frac{7}{2}$ –236511° $\frac{7}{2}$	2552.774	15	39161.32	197375 $\frac{9}{2}$ –236537° $\frac{9}{2}$
2514.658	25	39754.87	196795 $\frac{9}{2}$ –236550° $\frac{9}{2}$	2553.115	400	39156.09	197375 $\frac{9}{2}$ –236531° $\frac{11}{2}$
2514.700	3	39754.21	196730 $\frac{5}{2}$ –236484° $\frac{3}{2}$	2553.490	10	39150.34	195340 $\frac{5}{2}$ –234490° $\frac{5}{2}$
2514.753	10	39753.37	198061 $\frac{5}{2}$ –237814° $\frac{3}{2}$	2553.712	3	39146.94	195343 $\frac{7}{2}$ –234490° $\frac{5}{2}$
2514.906	3	39750.95	195061 $\frac{9}{2}$ –234812° $\frac{7}{2}$	2554.000	8	39142.52	214989 $\frac{5}{2}$ –254132° $\frac{7}{2}$

TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (air)	Intensity	Wavenumber	Transition	$\lambda$ (air)	Intensity	Wavenumber	Transition
2554.295	75	39138.00	211679 $5/2$ —250817° $7/2$	2599.916	1	38451.29	198033 $1/2$ —236484° $3/2$
2554.419	125	39136.10	195518 $9/2$ —234654° $9/2$	2599.983	3	38450.30	198061 $5/2$ —236511° $7/2$
			214989 $5/2$ —254125° $5/2$	2601.335	10	38430.31	196100 $3/2$ —234530° $1/2$
2554.985	1	39127.44	198687 $9/2$ —237814° $7/2$	2602.710	5	38410.01	198061 $5/2$ —236471° $5/2$
2557.129	3	39094.63		2603.664	4	38395.94	216376 $5/2$ —254772° $7/2$
2557.315	25	39091.79	198687 $9/2$ —237778° $9/2$	2604.387	0	38385.28	197985 $3/2$ —236370° $1/2$
2557.656	15	39086.58	195340 $5/2$ —234427° $3/2$	2607.589	0	38338.15	197985 $3/2$ —236323° $1/2$
2560.460	10	39043.77	195518 $9/2$ —234562° $7/2$	2607.644	3	38337.34	198033 $1/2$ —236370° $1/2$
2561.251	15	39031.72	215100 $5/2$ —254132° $7/2$	2607.884	5	38333.81	198061 $5/2$ —236395° $3/2$
2561.737	5	39024.31	195788 $7/2$ —234812° $7/2$	2608.448	10	38325.53	
2562.163	5	39017.82	197593 $7/2$ —236611° $7/2$	2609.320	500	38312.72	80552 $5/2$ —118864° $7/2$
2564.176	10	38987.20	215807 $3/2$ —254794° $5/2$	2611.473	10	38281.13	
2564.247	8	38986.12	195788 $7/2$ —234774° $9/2$	2620.090	3	38155.24	215976 $7/2$ —254132° $7/2$
2565.188	3	38971.82		2624.228	20	38095.08	
2566.044	10	38958.82	195757 $11/2$ —234716° $11/2$	2625.116	15	38082.19	196730 $5/2$ —234812° $7/2$
2566.143	1	38957.31	198687 $9/2$ —237644° $9/2$	2625.924	0	38070.48	196742 $7/2$ —234812° $7/2$
2566.371	400	38953.85	198687 $9/2$ —237641° $11/2$	2627.063	1	38053.97	215976 $7/2$ —254030° $7/2$
2567.054	50	38943.49	197593 $7/2$ —236537° $9/2$	2627.738	10	38044.20	196730 $5/2$ —234775° $5/2$
2568.742	8	38917.90	197593 $7/2$ —236511° $7/2$	2628.491	10	38033.30	
2569.065	15	38913.01	195757 $11/2$ —234670° $13/2$	2628.550	0	38032.45	
2569.147	10	38911.77	215761 $1/2$ —254673° $3/2$	2629.449	10	38019.44	196742 $7/2$ —234774° $9/2$
2569.358	3	38908.57	223089 $9/2$ —261998° $11/2$	2632.238	5	37979.16	196795 $9/2$ —234774° $9/2$
2569.530	20	38905.97	223089 $9/2$ —261995° $9/2$	2635.667	3	37929.75	196730 $5/2$ —234660° $3/2$
2569.723	5	38903.04		2636.258	1	37921.25	196795 $9/2$ —234716° $11/2$
2569.908	5	38900.24	198930 $7/2$ —237830° $5/2$	2636.891	0	37912.15	196742 $7/2$ —234654° $9/2$ ?
2570.139	1	38896.75	195757 $11/2$ —234654° $9/2$	2638.393	1	37893.57	216235 $3/2$ —254125° $5/2$
2570.266	3	38894.83		2638.726	15	37885.79	196795 $9/2$ —234681° $11/2$
2570.972	150	38884.15	198930 $7/2$ —237814° $7/2$	2640.297	1	37863.25	198687 $9/2$ —236550° $9/2$
2571.820	2	38871.32		2641.222	1	37849.99	198687 $9/2$ —236537° $9/2$
2572.747	10	38857.32		2641.537	50	37845.47	89046 $7/2$ —126892° $5/2$
2573.329	400	38848.53	198930 $7/2$ —237778° $9/2$	2643.923	200	37811.32	89018 $7/2$ —126829° $5/2$
2574.823	2	38825.99		2645.914	2	37782.87	89046 $7/2$ —126829° $7/2$
2574.998	30	38823.35	223175 $11/2$ —261998° $11/2$	2646.383	15	37776.17	223787 $5/2$ —261563° $7/2$
2575.119	35	38821.53	223174 $7/2$ —261995° $9/2$	2649.519	20	37731.47	198687 $9/2$ —236418 $11/2$
2575.166	1	38820.82	198930 $7/2$ —237751° $7/2$	2652.095	4	37694.82	
2576.023	15	38807.91	195722 $1/2$ —234530° $1/2$	2652.854	3	37684.03	213133 $5/2$ —250817° $7/2$
2576.454	3	38801.42		2653.075	3	37680.89	198930 $7/2$ —236611° $5/2$
2576.581	5	38799.50		2655.769	10	37642.67	197038 $11/2$ —234681° $11/2$
2576.724	30	38797.35	223200 $9/2$ —261998° $11/2$	2656.493	0	37632.42	197038 $11/2$ —234670° $13/2$
2577.594	1	38784.26	196028 $9/2$ —234812° $7/2$	2657.485	3	37618.37	
2577.765	35	38781.68	216145 $5/2$ —254926° $7/2$	2658.314	20	37606.64	198930 $7/2$ —236537° $9/2$
2578.212	150	38774.96	195757 $11/2$ —234532° $13/2$	2658.822	3	37599.45	197055 $7/2$ —234654° $9/2$
2580.135	125	38746.06	196028 $9/2$ —234774° $9/2$	2660.128	2	37580.99	198930 $7/2$ —236511° $9/2$
2581.173	125	38730.48	223089 $9/2$ —261820° $11/2$	2665.384	3	37506.89	197055 $7/2$ —234562° $7/2$
2582.264	5	38714.12	198930 $7/2$ —237644° $9/2$	2670.481	30	37435.31	197055 $7/2$ —234490° $5/2$ ?
2582.478	2	38710.91	197900 $5/2$ —236611° $7/2$	2673.090	10	37398.77	197375 $9/2$ —234774° $9/2$
2583.882	1	38689.88	197900 $5/2$ —236590° $5/2$	2674.646	10	37377.02	
2584.001	15	38688.10	196028 $9/2$ —234716° $11/2$	2677.231	2	37340.93	197375 $9/2$ —234716° $11/2$
2584.888	5	38674.82	196100 $3/2$ —234775° $5/2$	2679.773	50	37305.51	197375 $9/2$ —234681° $11/2$
2585.012	3	38672.97	223089 $9/2$ —261762° $7/2$	2679.963	3	37302.87	
2585.393	1	38667.27	223089 $9/2$ —261757° $9/2$	2688.100	2	37189.95	85447 $3/2$ —122637° $1/2$
2586.369	75	38652.68	196028 $9/2$ —234681° $11/2$	2692.242	15	37132.74	
2586.589	5	38649.39	216145 $5/2$ —254794° $5/2$	2696.378	200	37075.79	89018 $9/2$ —126094° $7/2$
2587.420	150	38636.98	223175 $11/2$ —261812° $13/2$	2698.441	50	37047.44	89046 $7/2$ —126094° $7/2$
2588.068	10	38627.30	216145 $5/2$ —254772° $7/2$	2707.844	5	36918.80	213815 $7/2$ —250734° $9/2$
2588.159	10	38625.95	196028 $9/2$ —234654° $9/2$	2707.904	1	36917.98	213815 $7/2$ —250733° $7/2$
2588.594	10	38619.46	223200 $9/2$ —261820° $11/2$	2708.317	8	36912.35	197900 $5/2$ —234812° $7/2$
2589.159	10	38611.03	197900 $5/2$ —236511° $7/2$	2711.102	8	36874.44	197900 $5/2$ —234775° $5/2$
2589.573	10	38604.86	197985 $3/2$ —236590° $5/2$	2719.540	2	36760.03	197900 $5/2$ —234660° $3/2$
2590.677	15	38588.41	223174 $7/2$ —261762° $7/2$	2725.573	5	36678.67	
2591.102	3	38582.08	223175 $11/2$ —261757° $9/2$ ?	2730.267	15	36615.61	201215 $5/2$ —237830° $5/2$
2591.864	5	38570.73	197900 $5/2$ —236471° $5/2$	2731.466	25	36599.54	201215 $5/2$ —237814° $7/2$
2592.564	5	38560.32	196100 $3/2$ —234660° $3/2$	2737.491	1	36518.99	201215 $5/2$ —237734° $3/2$
2592.643	3	38559.15	216235 $3/2$ —254794° $5/2$	2738.652	3	36503.51	86133 $1/2$ —122637° $1/2$
2592.846	30	38556.13	223200 $9/2$ —261757° $9/2$ ?	2741.967	2	36459.38	201215 $5/2$ —237674° $5/2$
2593.244	2	38550.21	198061 $5/2$ —236611° $7/2$	2743.940	5	36433.17	
2594.370	1	38533.48	196028 $9/2$ —234562° $7/2$	2751.330	20	36335.32	89046 $7/2$ —125382° $5/2$
2594.648	0?	38529.35	198061 $5/2$ —236590° $5/2$	2769.378	10	36098.53	201732 $3/2$ —237830° $5/2$
2596.667	8	38499.40	197985 $3/2$ —236484° $3/2$	2776.817	10	36001.83	201732 $3/2$ —237734° $3/2$
2596.995	3	38494.53	197900 $5/2$ —236395° $3/2$	2777.510	0	35992.85	153609° $7/2$ —189602° $7/2$
2597.332	10	38489.54		2781.424	5	35942.20	201732 $3/2$ —237674° $5/2$
2598.522	50	38471.91	215976 $7/2$ —254448° $9/2$	2787.865	2	35859.17	201732 $3/2$ —237591° $5/2$
2599.240	3	38461.29		2791.966	0	35806.50	201732 $3/2$ —237538° $3/2$



TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (air)	Intensity	Wavenumber	Transition	$\lambda$ (air)	Intensity	Wavenumber	Transition
2798.946	3	35717.21	215100 $\frac{5}{2}$ –250817° $\frac{7}{2}$	3689.446	25	27096.63	
2812.943	100	35539.49	89018 $\frac{9}{2}$ –124557° $\frac{7}{2}$	3689.660	15	27095.06	142513° $\frac{3}{2}$ –169608 $\frac{3}{2}$
2822.070	5	35424.55	89018 $\frac{9}{2}$ –124442° $\frac{9}{2}$	3690.151	20	27091.45	
2825.990	10	35375.42	201215 $\frac{5}{2}$ –236590° $\frac{5}{2}$	3691.752	15	27079.70	
2835.546	3	35256.21	201215 $\frac{5}{2}$ –236471° $\frac{5}{2}$	3694.662	75	27058.37	215160° $\frac{1}{2}$ –242219 $\frac{3}{2}$
2841.687	2	35180.02	201215 $\frac{5}{2}$ –236395° $\frac{3}{2}$	3694.766	10	27057.61	142550° $\frac{1}{2}$ –169608 $\frac{3}{2}$
2867.916	3	34858.29	201732 $\frac{3}{2}$ –236590° $\frac{5}{2}$	3696.693	5	27043.51	212525° $\frac{11}{2}$ –239568 $\frac{9}{2}$
2876.624	5	34752.77	201732 $\frac{3}{2}$ –236484° $\frac{3}{2}$	3697.557	200	27037.19	213025° $\frac{3}{2}$ –240062 $\frac{5}{2}$
2975.508	100	33597.90	201215 $\frac{5}{2}$ –234812° $\frac{7}{2}$	3698.035	75	27033.69	214357° $\frac{3}{2}$ –241391 $\frac{3}{2}$
2978.866	100	33560.03	201215 $\frac{5}{2}$ –234775° $\frac{5}{2}$	3698.452	3	27030.65	223787° $\frac{5}{2}$ –250817° $\frac{7}{2}$
2988.000	2	33457.44	89046 $\frac{7}{2}$ –122504° $\frac{7}{2}$	3699.154	60	27025.52	212415° $\frac{9}{2}$ –239440 $\frac{7}{2}$
2989.070	30	33445.47	201215 $\frac{5}{2}$ –234660° $\frac{3}{2}$	3700.000	10	27019.34	
3093.220	3	32319.39	89018 $\frac{9}{2}$ –121337° $\frac{9}{2}$	3700.752	5	27013.85	213311° $\frac{7}{2}$ –240325 $\frac{5}{2}$
3281.123	1	30468.59	213311° $\frac{7}{2}$ –243780 $\frac{5}{2}$	3701.060	10	27011.60	
3294.457	5	30345.28	223787 $\frac{5}{2}$ –254132° $\frac{7}{2}$	3701.811	20	27006.12	215000° $\frac{7}{2}$ –242006 $\frac{5}{2}$
3358.730	3	29764.60		3702.920	500	26998.03	211821° $\frac{7}{2}$ –238818 $\frac{5}{2}$
3394.340	2	29452.35	214328° $\frac{7}{2}$ –243780 $\frac{5}{2}$	3703.921	50	26990.74	214702° $\frac{3}{2}$ –241693 $\frac{5}{2}$
3438.088	10	29077.60	214702° $\frac{5}{2}$ –243780 $\frac{5}{2}$	3706.757	40	26970.09	214357° $\frac{3}{2}$ –241328 $\frac{3}{2}$
3445.623	3	29014.01	214766° $\frac{5}{2}$ –243780 $\frac{5}{2}$	3708.538	8	26957.13	
3473.651	3	28779.91	215000° $\frac{7}{2}$ –243780 $\frac{5}{2}$	3710.228	15	26944.86	223787° $\frac{5}{2}$ –250731° $\frac{5}{2}$
3533.762	2	28290.37	201215 $\frac{5}{2}$ –229505° $\frac{3}{2}$	3710.483	40	26943.00	239148° $\frac{5}{2}$ –266091 $\frac{5}{2}$
3542.052	2	28224.16	213025° $\frac{5}{2}$ –241249 $\frac{7}{2}$	3713.405	65	26921.80	214328° $\frac{7}{2}$ –241249 $\frac{7}{2}$
3545.430	10	28197.27	238833° $\frac{7}{2}$ –267031 $\frac{5}{2}$	3714.616	20	26913.03	
3548.870	75	28169.94	216448° $\frac{3}{2}$ –244618 $\frac{3}{2}$	3715.037	400	26909.98	211821° $\frac{7}{2}$ –238730 $\frac{7}{2}$
3549.926	10	28161.56	239148° $\frac{5}{2}$ –267310 $\frac{3}{2}$	3715.705	3	26905.14	
3555.834	5	28114.77		3719.900	300	26874.80	212415° $\frac{9}{2}$ –239290 $\frac{9}{2}$
3558.126	8	28096.66		3720.180	75	26872.78	215417° $\frac{5}{2}$ –242290 $\frac{5}{2}$
3563.695	30	28052.75	216565° $\frac{5}{2}$ –244618 $\frac{3}{2}$	3721.071	40	26866.34	231333° $\frac{5}{2}$ –258199 $\frac{7}{2}$
3564.251	20	28048.38	213025° $\frac{5}{2}$ –241074 $\frac{7}{2}$	3722.333	2	26857.23	
3568.751	20	28013.01		3726.167	75	26829.60	
3579.098	10	27932.03	214357° $\frac{3}{2}$ –242290 $\frac{5}{2}$	3726.825	20	26824.86	212415° $\frac{9}{2}$ –239240 $\frac{11}{2}$
3582.717	8	27903.81	213311° $\frac{7}{2}$ –241215 $\frac{9}{2}$	3727.850	5	26817.49	211821° $\frac{7}{2}$ –238638 $\frac{7}{2}$
3584.579	10	27889.32	214357° $\frac{3}{2}$ –242247 $\frac{3}{2}$	3728.393	2	26813.58	
3585.364	5	27883.21	201215 $\frac{5}{2}$ –229098° $\frac{7}{2}$ ?	3730.041	5	26801.74	215417° $\frac{5}{2}$ –242219 $\frac{3}{2}$
3588.221	2	27861.01	214357° $\frac{3}{2}$ –242219 $\frac{7}{2}$	3730.693	10	26797.05	
3589.005	10	27854.93	238788° $\frac{9}{2}$ –266643 $\frac{7}{2}$	3731.661	2	26790.10	228960° $\frac{5}{2}$ –255750 $\frac{3}{2}$
3593.553	25	27819.67	238833° $\frac{7}{2}$ –266653 $\frac{9}{2}$ ?	3734.453	3	26770.07	
3594.867	50h	27809.51	238788° $\frac{7}{2}$ –266597 $\frac{9}{2}$	3735.201	75	26764.71	212525° $\frac{11}{2}$ –239290 $\frac{9}{2}$
			238833° $\frac{7}{2}$ –266643 $\frac{7}{2}$	3735.597	5	26761.87	
3600.141	25	27768.77	213025° $\frac{5}{2}$ –240794 $\frac{3}{2}$	3736.425	150	26755.94	238788° $\frac{9}{2}$ –265544 $\frac{11}{2}$
3600.777	5	27763.86	238833° $\frac{7}{2}$ –266597 $\frac{9}{2}$	3737.108	75	26751.05	213311° $\frac{7}{2}$ –240062 $\frac{7}{2}$
3600.962	20h	27762.44	216017° $\frac{7}{2}$ –243780 $\frac{5}{2}$	3737.279	75	26749.83	228423° $\frac{5}{2}$ –255173 $\frac{7}{2}$
			213311° $\frac{7}{2}$ –241074 $\frac{7}{2}$	3737.807	85	26746.05	214328° $\frac{7}{2}$ –241074 $\frac{7}{2}$
3602.843	5	27747.94	211821° $\frac{7}{2}$ –239568 $\frac{9}{2}$	3738.812	65	26738.86	215160° $\frac{1}{2}$ –241899 $\frac{1}{2}$
3611.321	2	27682.80	213311° $\frac{7}{2}$ –240994 $\frac{5}{2}$	3742.188	150	26714.74	212525° $\frac{11}{2}$ –239240 $\frac{11}{2}$
3611.883	20	27678.50	214328° $\frac{7}{2}$ –242006 $\frac{5}{2}$	3744.698	800	26696.83	212415° $\frac{9}{2}$ –239112 $\frac{11}{2}$
3614.201	15	27660.74	213311° $\frac{7}{2}$ –240972 $\frac{9}{2}$	3746.817	20	26681.74	
3615.795	15	27648.55	214357° $\frac{3}{2}$ –242006 $\frac{5}{2}$	3748.266	400	26671.42	215417° $\frac{5}{2}$ –242088 $\frac{7}{2}$
3619.566	15	27619.75	211821° $\frac{7}{2}$ –239440 $\frac{7}{2}$	3748.956	5	26666.51	214328° $\frac{7}{2}$ –240994 $\frac{5}{2}$
3632.211	5	27523.59	214766° $\frac{5}{2}$ –242290 $\frac{5}{2}$	3749.657	2	26661.53	214588° $\frac{9}{2}$ –241249 $\frac{7}{2}$
3633.173	5	27516.31	214702° $\frac{5}{2}$ –242219 $\frac{3}{2}$	3750.370	10	26656.46	
3633.888	10	27510.89	239142° $\frac{11}{2}$ –266653 $\frac{9}{2}$	3750.646	5	26654.50	
3636.000	65	27494.91	239142° $\frac{11}{2}$ –266637 $\frac{11}{2}$	3752.056	600	26644.48	214328° $\frac{7}{2}$ –240972 $\frac{9}{2}$
3636.094	15	27494.20	239148° $\frac{5}{2}$ –266643 $\frac{7}{2}$	3753.166	75	26636.60	214357° $\frac{3}{2}$ –240994 $\frac{5}{2}$
3637.319	2	27484.94		3754.480	200	26627.28	214588° $\frac{9}{2}$ –241215 $\frac{9}{2}$
3639.420	100	27469.08	211821° $\frac{7}{2}$ –239290 $\frac{9}{2}$	3754.759	50	26625.30	214702° $\frac{5}{2}$ –241328 $\frac{9}{2}$
3641.256	5	27455.23	239142° $\frac{11}{2}$ –266597 $\frac{9}{2}$				214766° $\frac{5}{2}$ –241391 $\frac{3}{2}$
3641.598	3	27452.65	214766° $\frac{5}{2}$ –242219 $\frac{3}{2}$	3756.408	3	26613.61	
3645.893	3	27420.31		3759.424	100	26592.26	216017° $\frac{7}{2}$ –242610 $\frac{7}{2}$
3650.474	5	27385.90	214702° $\frac{5}{2}$ –242088 $\frac{7}{2}$	3760.056	25	26587.79	229505° $\frac{3}{2}$ –256093 $\frac{5}{2}$
3657.193	3	27335.59	214357° $\frac{3}{2}$ –241693 $\frac{5}{2}$	3760.215	150	26586.67	212525° $\frac{11}{2}$ –239112 $\frac{11}{2}$
3657.724	50	27331.62	216448° $\frac{3}{2}$ –243780 $\frac{5}{2}$	3760.734	15	26583.00	
3658.388	15	27326.66	228423° $\frac{5}{2}$ –255750 $\frac{3}{2}$	3762.052	150	26573.69	212995° $\frac{9}{2}$ –239568 $\frac{9}{2}$
3658.971	10	27322.30	214766° $\frac{5}{2}$ –242088 $\frac{7}{2}$	3762.286	65	26572.03	
3661.453	100	27303.78	214702° $\frac{5}{2}$ –242006 $\frac{5}{2}$	3763.762	5	26561.61	214766° $\frac{5}{2}$ –241328 $\frac{3}{2}$
3661.975	2	27299.89	213025° $\frac{5}{2}$ –240325 $\frac{5}{2}$	3763.992	100	26559.99	232458° $\frac{5}{2}$ –259018 $\frac{7}{2}$
3664.472	10	27281.29	228468° $\frac{3}{2}$ –255750 $\frac{3}{2}$ ?	3765.014	10	26552.78	231333° $\frac{5}{2}$ –257885 $\frac{5}{2}$
3664.511	5	27281.00	228468° $\frac{3}{2}$ –255750 $\frac{3}{2}$	3765.840	20	26546.96	214702° $\frac{5}{2}$ –241249 $\frac{7}{2}$
3669.195	50	27246.17	238833° $\frac{7}{2}$ –266079 $\frac{7}{2}$	3768.729	50	26526.61	228960° $\frac{5}{2}$ –255486 $\frac{7}{2}$
3673.455	75	27214.58	216565° $\frac{5}{2}$ –243780 $\frac{5}{2}$	3770.928	15	26511.14	
3675.872	2	27196.68		3771.150	20	26509.58	
3678.604	20	27176.49	138982° $\frac{7}{2}$ –166159 $\frac{9}{2}$	3771.523	100	26506.96	215782° $\frac{3}{2}$ –242290 $\frac{5}{2}$
3681.692	60	27153.69	212415° $\frac{9}{2}$ –239568 $\frac{9}{2}$	3771.878	2	26504.46	238788° $\frac{9}{2}$ –265292 $\frac{9}{2}$ ?

TABLE 1. Observed lines of Cu III—Continued

$\lambda$ (air)	Intensity	Wavenumber	Transition	$\lambda$ (air)	Intensity	Wavenumber	Transition
3774.547	50	26485.72	214588° <sub>9/2</sub> – 241074 <sub>7/2</sub>	3881.682	300	25754.73	212525° <sub>11/2</sub> – 238280 <sub>9/2</sub>
3774.793	50	26484.00		3883.169	8	25744.87	240852° <sub>9/2</sub> – 266597 <sub>9/2</sub>
3774.886	150	26483.34	214766° <sub>5/2</sub> – 241249 <sub>7/2</sub>	3884.549 <sup>b</sup>	75	25735.72	212995° <sub>9/2</sub> – 238730 <sub>7/2</sub>
3776.971	1000	26468.72	212525° <sub>11/2</sub> – 238994 <sub>13/2</sub>	3884.772	30	25734.24	228960° <sub>5/2</sub> – 254694 <sub>3/2</sub>
3778.344	100	26459.11	238833° <sub>7/2</sub> – 265292 <sub>9/2</sub>	3885.921	40	25726.63	
			211821° <sub>7/2</sub> – 238280 <sub>9/2</sub>	3887.702	200	25714.85	214588° <sub>9/2</sub> – 240303 <sub>7/2</sub>
3780.052	100	26447.15	239142° <sub>11/2</sub> – 265589 <sub>13/2</sub>	3889.208	0	25704.89	214357° <sub>3/2</sub> – 240062 <sub>5/2</sub>
3781.561	75	26436.60	214357° <sub>3/2</sub> – 240794 <sub>3/2</sub>	3890.799	20	25694.38	
3781.631	50	26436.11	215782° <sub>3/2</sub> – 242219 <sub>3/2</sub>	3893.605	85	25675.86	216017° <sub>7/2</sub> – 241693 <sub>5/2</sub>
3782.520	5	26429.89	142427° <sub>5/2</sub> – 168856 <sub>5/2</sub>	3894.203	10	25671.92	
3782.732	3	26428.41	231457° <sub>3/2</sub> – 257885 <sub>5/2</sub>	3898.545	75	25643.33	212995° <sub>9/2</sub> – 238638 <sub>7/2</sub>
3784.030	100	26419.35	232435° <sub>7/2</sub> – 258855 <sub>9/2</sub>	3901.662	25	25622.84	214702° <sub>5/2</sub> – 240325 <sub>5/2</sub>
3784.657	75	26414.97	213025° <sub>5/2</sub> – 239440 <sub>7/2</sub>	3902.294	50	25618.69	
3785.914	10	26406.20	214357° <sub>3/2</sub> – 240764 <sub>1/2</sub>	3903.222	100	25612.60	213025° <sub>5/2</sub> – 238638 <sub>7/2</sub>
3789.070	3	26384.21	214588° <sub>9/2</sub> – 240972 <sub>9/2</sub>	3903.829	30	25608.62	215782° <sub>3/2</sub> – 241391 <sub>3/2</sub>
3790.798	800	26372.18	214588° <sub>9/2</sub> – 240960 <sub>11/2</sub>	3904.651	3	25603.23	215160° <sub>1/2</sub> – 240764 <sub>1/2</sub>
3790.931	100	26371.26	214702° <sub>5/2</sub> – 241074 <sub>7/2</sub>	3905.079	50	25600.42	214702° <sub>5/2</sub> – 240303 <sub>7/2</sub>
3792.486	85	26360.44	229098° <sub>7/2</sub> – 255458 <sub>9/2</sub>	3908.611	10	25577.29	215417° <sub>5/2</sub> – 240994 <sub>5/2</sub>
3794.880	50	26343.81	142513° <sub>3/2</sub> – 168856 <sub>5/2</sub>	3911.361	50	25559.31	214766° <sub>5/2</sub> – 240325 <sub>5/2</sub>
3798.931	65	26315.72	212415° <sub>9/2</sub> – 238730 <sub>7/2</sub>	3911.578	20	25557.89	216448° <sub>3/2</sub> – 242006 <sub>5/2</sub>
3799.103	10	26314.53		3913.545	40	25545.05	215782° <sub>3/2</sub> – 241328 <sub>3/2</sub>
3801.009	100	26301.34	213025° <sub>5/2</sub> – 239326 <sub>3/2</sub>	3914.802	15	25536.84	214766° <sub>5/2</sub> – 240303 <sub>7/2</sub>
3801.948	75	26294.84	212995° <sub>9/2</sub> – 239290 <sub>9/2</sub>	3917.101	50	25521.86	229098° <sub>7/2</sub> – 254620 <sub>5/2</sub>
3802.385	5	26291.82	214702° <sub>5/2</sub> – 240994 <sub>5/2</sub>	3928.168	40	25449.95	232435° <sub>7/2</sub> – 257885 <sub>5/2</sub>
3804.132	600	26279.75	216017° <sub>7/2</sub> – 242297 <sub>9/2</sub>	3929.587	60	25440.76	216565° <sub>5/2</sub> – 242006 <sub>5/2</sub>
3807.414	300	26257.09	213311° <sub>7/2</sub> – 239568 <sub>9/2</sub>	3932.931	40	25419.13	213311° <sub>7/2</sub> – 238730 <sub>7/2</sub>
3808.547	65	26249.28	215000° <sub>7/2</sub> – 241249 <sub>7/2</sub>	3939.420	2	25377.26	215417° <sub>5/2</sub> – 240794 <sub>3/2</sub>
3809.175	600	26244.95	212995° <sub>9/2</sub> – 239240 <sub>11/2</sub>	3940.397	1	25370.97	
3811.588	85	26228.34	214766° <sub>5/2</sub> – 240994 <sub>5/2</sub>	3942.098	1	25360.02	214702° <sub>5/2</sub> – 240062 <sub>5/2</sub>
3812.012	5	26225.42	228468° <sub>3/2</sub> – 254694 <sub>3/2</sub>	3947.284	100	25326.71	213311° <sub>7/2</sub> – 238638 <sub>7/2</sub>
3812.312	65	26223.36	212415° <sub>9/2</sub> – 238638 <sub>7/2</sub>	3947.512	10	25325.24	215000° <sub>7/2</sub> – 240325 <sub>5/2</sub>
3813.519	300	26215.06	215000° <sub>7/2</sub> – 241215 <sub>9/2</sub>	3949.572	60	25312.04	142427° <sub>5/2</sub> – 167739 <sub>7/2</sub>
3813.770	10	26213.33	228960° <sub>5/2</sub> – 255173 <sub>7/2</sub>	3950.620	15	25305.32	240786° <sub>7/2</sub> – 266091 <sub>5/2</sub>
3815.218	3	26203.38		3951.022	100	25302.75	215000° <sub>7/2</sub> – 240303 <sub>7/2</sub>
3816.170	20	26196.85	228423° <sub>5/2</sub> – 254620 <sub>5/2</sub>	3953.809	150	25284.91	212995° <sub>9/2</sub> – 238280 <sub>9/2</sub>
3820.473	20	26167.34	215160° <sub>1/2</sub> – 241328 <sub>3/2</sub>	3960.072	50	25244.92	216448° <sub>3/2</sub> – 241693 <sub>5/2</sub>
3821.571	2	26159.83		3960.720	8	25240.79	214328° <sub>7/2</sub> – 239568 <sub>7/2</sub>
3822.800	3	26151.42	228468° <sub>3/2</sub> – 254620 <sub>5/2</sub>	3962.877	15	25227.05	240852° <sub>9/2</sub> – 266079 <sub>7/2</sub>
3822.942	50	26150.44	239142° <sub>11/2</sub> – 265292 <sub>9/2</sub>	3968.852	20	25189.08	229505° <sub>3/2</sub> – 254694 <sub>3/2</sub>
3826.089	100	26128.94	213311° <sub>7/2</sub> – 239440 <sub>7/2</sub>	3978.532	100	25127.79	216565° <sub>5/2</sub> – 241693 <sub>5/2</sub>
3827.893	10	26116.62	215782° <sub>3/2</sub> – 241899 <sub>1/2</sub>	3980.574	15	25114.90	229505° <sub>3/2</sub> – 254620 <sub>5/2</sub>
3831.531	85	26091.82	214702° <sub>5/2</sub> – 240794 <sub>3/2</sub>	3980.930	30	25112.66	214328° <sub>7/2</sub> – 239440 <sub>7/2</sub>
3833.768	5	26076.60		3988.923	10	25062.34	215000° <sub>7/2</sub> – 240062 <sub>5/2</sub>
3834.022	50	26074.87	229098° <sub>7/2</sub> – 255173 <sub>7/2</sub>	4008.025	10	24942.89	216448° <sub>3/2</sub> – 241391 <sub>3/2</sub>
3834.211	75	26073.59	215000° <sub>7/2</sub> – 241074 <sub>7/2</sub>	4011.858	15	24919.06	142820° <sub>7/2</sub> – 167739 <sub>7/2</sub>
3838.525	100	26044.29	216565° <sub>5/2</sub> – 242610 <sub>7/2</sub>	4013.577	10	24908.39	215417° <sub>5/2</sub> – 240325 <sub>5/2</sub>
3839.461	5	26037.94		4019.430	15	24872.12	
3840.894	20	26028.22	214766° <sub>5/2</sub> – 240794 <sub>3/2</sub>	4037.268	5	24762.23	216565° <sub>5/2</sub> – 241328 <sub>3/2</sub>
3845.412	75	25997.64	214328° <sub>7/2</sub> – 240325 <sub>5/2</sub>	4039.580	10	24748.06	234654° <sub>9/2</sub> – 259402° <sub>9/2</sub>
3845.937	15	25994.09	215000° <sub>7/2</sub> – 240994 <sub>5/2</sub>	4041.242	30	24737.88	214702° <sub>5/2</sub> – 239440 <sub>7/2</sub>
3846.199	65	25992.32		4050.073	2	24683.94	216565° <sub>5/2</sub> – 241249 <sub>7/2</sub>
3846.720	3?	25988.80	216017° <sub>7/2</sub> – 242006 <sub>5/2</sub>	4051.651	30	24674.33	214766° <sub>5/2</sub> – 239440 <sub>7/2</sub>
3848.292	20	25978.19	213311° <sub>7/2</sub> – 239290 <sub>9/2</sub>	4059.889	40	24624.26	214702° <sub>5/2</sub> – 239326 <sub>3/2</sub>
3848.739	5	25975.17	214328° <sub>7/2</sub> – 240303 <sub>7/2</sub>	4069.123	10	24568.38	215000° <sub>7/2</sub> – 239568 <sub>9/2</sub>
3848.859	15	25974.36	215417° <sub>5/2</sub> – 241391 <sub>3/2</sub>	4070.395	20	24560.70	214766° <sub>5/2</sub> – 239326 <sub>3/2</sub>
3849.208	20	25972.00	215000° <sub>7/2</sub> – 240972 <sub>9/2</sub>	4072.843	30	24545.94	216448° <sub>3/2</sub> – 240994 <sub>5/2</sub>
3849.845	65	25967.71	214357° <sub>3/2</sub> – 240325 <sub>5/2</sub>	4078.337	15	24512.88	
3858.078	1	25912.29		4090.487	100	24443.07	215000° <sub>7/2</sub> – 239440 <sub>7/2</sub>
3858.305	60	25910.77	215417° <sub>5/2</sub> – 241328 <sub>3/2</sub>				240852° <sub>9/2</sub> – 265292 <sub>9/2</sub>
3860.875	5	25893.52		4092.376	2	24428.79	216565° <sub>5/2</sub> – 240994 <sub>5/2</sub>
3864.866	10	25866.78	240786° <sub>7/2</sub> – 266653 <sub>9/2</sub>	4096.722	3	24402.87	214328° <sub>7/2</sub> – 238730 <sub>7/2</sub>
3865.153	80	25864.86	212415° <sub>9/2</sub> – 238280 <sub>9/2</sub>	4106.327	30	24345.79	216448° <sub>3/2</sub> – 240794 <sub>3/2</sub>
3866.390	40	25856.59	240786° <sub>7/2</sub> – 266643 <sub>7/2</sub>	4112.299	10	24310.44	214328° <sub>7/2</sub> – 238638 <sub>7/2</sub>
3868.682	5	25841.27	216448° <sub>3/2</sub> – 242290 <sub>5/2</sub>	4125.237	10	24234.19	
3869.158	1	25838.09		4149.236	2	24094.03	
3870.002	2	25832.46	215417° <sub>5/2</sub> – 241249 <sub>7/2</sub>	4186.957	15	23876.97	216448° <sub>3/2</sub> – 240325 <sub>5/2</sub>
3873.200 <sup>b</sup>	50	25811.13	240786° <sub>7/2</sub> – 266597 <sub>9/2</sub>				210159° <sub>5/2</sub> – 234036° <sub>3/2</sub>
3873.958	20	25806.08		4187.807	10	23872.12	214766° <sub>5/2</sub> – 238638 <sub>7/2</sub>
3874.790	40	25800.54	240852° <sub>9/2</sub> – 266653 <sub>9/2</sub>	4191.723	5	23849.82	234036° <sub>3/2</sub> – 257885 <sub>5/2</sub>
3875.081	65	25798.60	216448° <sub>3/2</sub> – 242247 <sub>3/2</sub>	4197.252	2	23818.40	215000° <sub>7/2</sub> – 238818 <sub>5/2</sub>
3875.244	10	25797.51		4212.301	20	23733.31	215100° <sub>5/2</sub> – 238833° <sub>7/2</sub>
3875.883	1	25793.26	213025° <sub>5/2</sub> – 238818 <sub>5/2</sub>	4232.447	8	23620.34	210033° <sub>3/2</sub> – 233653° <sub>3/2</sub>
3877.197	75	25784.52	240852° <sub>9/2</sub> – 266637 <sub>11/2</sub>	4246.192	20	23543.88	144195° <sub>5/2</sub> – 167739 <sub>7/2</sub>

TABLE 1. Observed lines of Cu III—Continued

$\lambda$ (air)	Intensity	Wavenumber	Transition	$\lambda$ (air)	Intensity	Wavenumber	Transition
4253.549	2	23503.16	145353° <sub>3/2</sub> – 168856 <sub>5/2</sub>	4368.318	75	22885.68	236531° <sub>11/2</sub> – 259417 <sub>11/2</sub>
4270.654	8	23409.03	243234° <sub>7/2</sub> – 266643 <sub>7/2</sub> ?	4369.314	75	22880.46	236537° <sub>9/2</sub> – 259417 <sub>11/2</sub>
4283.400	200	23339.37	142820° <sub>7/2</sub> – 166159 <sub>9/2</sub>	4369.438	75	22879.81	236590° <sub>3/2</sub> – 259470 <sub>5/2</sub>
4286.475	3	23322.63		4370.126	300	22876.21	234654° <sub>9/2</sub> – 257530 <sub>11/2</sub>
4286.800	2	23320.86		4370.344	300	22875.07	234681° <sub>11/2</sub> – 257556 <sub>11/2</sub>
4298.294	10	23258.50		4370.841	500	22872.46	236531° <sub>11/2</sub> – 259404 <sub>13/2</sub>
4313.014	3	23179.12		4371.395	500	22869.57	234670° <sub>13/2</sub> – 257540 <sub>13/2</sub>
4313.330	100	23177.42	234490° <sub>5/2</sub> – 257668 <sub>7/2</sub>	4371.878	200	22867.04	237778° <sub>9/2</sub> – 260646 <sub>11/2</sub>
4313.661	100	23175.65	234427° <sub>3/2</sub> – 257602 <sub>3/2</sub>	4372.167	5	22865.53	236537° <sub>9/2</sub> – 259402 <sub>9/2</sub>
4316.650	3	23159.60		4372.446	5	22864.07	
4318.034	2	23152.18		4372.864	75	22861.88	237814° <sub>7/2</sub> – 260676 <sub>9/2</sub>
4318.313	1	23150.68		4373.429	500	22858.93	234681° <sub>11/2</sub> – 257540 <sub>13/2</sub>
4318.537	30	23149.48					234812° <sub>7/2</sub> – 257671 <sub>5/2</sub>
4321.522	2	23133.49		4374.154	10	22855.14	234812° <sub>7/2</sub> – 257668 <sub>7/2</sub>
4323.742	15	23121.61		4374.398	50	22853.87	236550° <sub>9/2</sub> – 259404 <sub>11/2</sub>
4325.539	2	23112.01	234490° <sub>5/2</sub> – 257602 <sub>3/2</sub>	4374.682	5	22852.38	236550° <sub>9/2</sub> – 259402 <sub>9/2</sub>
4326.118	2	23108.91	236323° <sub>1/2</sub> – 259432 <sub>3/2</sub>	4374.984	3	22850.81	234774° <sub>9/2</sub> – 257625 <sub>9/2</sub>
4328.657	8	23095.36	211679 <sub>5/2</sub> – 334775° <sub>5/2</sub> ?	4375.432	300	22848.47	234716° <sub>11/2</sub> – 257565 <sub>13/2</sub>
4332.157	2	23076.70		4376.243	5	22844.23	
4332.909	20	23072.70	250734° <sub>9/2</sub> – 273807 <sub>9/2</sub>	4376.649	15	22842.11	236590° <sub>3/2</sub> – 259432 <sub>3/2</sub>
4333.011	10	23072.15	234530° <sub>1/2</sub> – 257602 <sub>3/2</sub>	4377.113	1000	22839.69	234716° <sub>11/2</sub> – 257556 <sub>11/2</sub>
4333.574	3	23069.16		4378.064	75	22834.73	234660° <sub>3/2</sub> – 257495 <sub>1/2</sub>
4334.927	100	23061.95	234427° <sub>3/2</sub> – 257488 <sub>5/2</sub>	4378.991	10	22829.90	
4335.276	5	23060.10		4379.309	5	22828.24	234660° <sub>3/2</sub> – 257488 <sub>5/2</sub> ?
4335.787	20	23057.38		4381.002	3	22819.42	
4337.486	15	23048.35		4381.290	5	22817.92	237814° <sub>7/2</sub> – 260632 <sub>7/2</sub> ?
4338.221	2	23044.44		4382.026	100	22814.08	234716° <sub>11/2</sub> – 257530 <sub>11/2</sub>
4339.663	100	23036.78		4382.314	300	22812.58	234812° <sub>7/2</sub> – 257625 <sub>9/2</sub>
4341.874	10	23025.06					189602 <sub>7/2</sub> – 212415° <sub>9/2</sub>
4342.065	100	23024.04	234490° <sub>5/2</sub> – 257514 <sub>7/2</sub>	4382.686	10	22810.65	
4343.016	0	23019.00		4384.351	50	22801.99	237830° <sub>5/2</sub> – 260632 <sub>7/2</sub>
4343.490	2	23016.49		4384.561	100	22800.89	250999° <sub>9/2</sub> – 273800 <sub>7/2</sub>
4344.139	5	23013.05		4384.768	20	22799.82	214844 <sub>7/2</sub> – 237644° <sub>9/2</sub> ?
4344.339	100	23011.99	234562° <sub>7/2</sub> – 257574 <sub>9/2</sub>	4385.397	150	22796.55	251010° <sub>11/2</sub> – 273807 <sub>9/2</sub>
4344.466	100	23011.32	234660° <sub>3/2</sub> – 257671 <sub>5/2</sub>	4386.077	20	22793.01	
4345.004	50	23008.47	236471° <sub>5/2</sub> – 259479 <sub>7/2</sub>	4386.333	50	22791.68	251010° <sub>11/2</sub> – 273802 <sub>13/2</sub>
4345.203	30	23007.42	234532° <sub>13/2</sub> – 257540 <sub>13/2</sub>	4386.425	200	22791.21	236611° <sub>7/2</sub> – 259402 <sub>9/2</sub>
4346.038	40	23003.00	234537° <sub>15/2</sub> – 257540 <sub>15/2</sub>	4388.256	200?	22781.70	234774° <sub>9/2</sub> – 257556 <sub>11/2</sub>
4346.827	20	22998.82	236471° <sub>5/2</sub> – 259470 <sub>5/2</sub>	4389.123	100	22777.20	
4346.936	20	22998.24	234490° <sub>5/2</sub> – 257488 <sub>5/2</sub>	4390.258	5	22771.31	
4348.576	2	22989.57	250817° <sub>7/2</sub> – 273807 <sub>9/2</sub>	4391.488	5	22764.93	
4348.736	10	22988.73		4396.147	30	22740.80	
4349.099	150	22986.81	236417° <sub>13/2</sub> – 259404 <sub>13/2</sub>	4396.499	50	22738.98	250999° <sub>9/2</sub> – 273738 <sub>9/2</sub>
4349.331	50?	22985.58	236418° <sub>11/2</sub> – 259404 <sub>11/2</sub>	4399.732	75	22722.27	251010° <sub>11/2</sub> – 273732 <sub>11/2</sub>
4349.751	1	22983.36		4403.499	5	22702.84	
4349.849	3	22982.84	250817° <sub>7/2</sub> – 273800 <sub>7/2</sub>	4408.235	15	22678.45	
4350.746	20	22978.10		4409.880	30	22669.99	
4351.834	50	22972.36		4417.191	2	22632.47	
4351.971	500	22971.64	234532° <sub>13/2</sub> – 257504 <sub>15/2</sub>	4418.324	5	22626.66	
4352.219	5	22970.33		4418.977	2	22623.32	
4352.451	3?	22969.10		4438.030	3	22526.20	
4352.798	1000	22967.27	234537° <sub>15/2</sub> – 257504 <sub>17/2</sub>	4453.330	2	22448.81	194117 <sub>7/2</sub> – 216565° <sub>5/2</sub>
4353.308	3	22964.58	234530° <sub>1/2</sub> – 257495 <sub>1/2</sub>	4568.621	5	21882.31	194683 <sub>3/2</sub> – 216565° <sub>5/2</sub>
4354.525	10	22958.16	237674° <sub>5/2</sub> – 260632 <sub>7/2</sub>	4621.943	10	21629.86	193370 <sub>9/2</sub> – 215000° <sub>7/2</sub>
4355.237	500	22954.41	236417° <sub>13/2</sub> – 259372 <sub>15/2</sub>	4724.409	30	21160.75	
4355.478	200	22953.14	236418° <sub>11/2</sub> – 259371 <sub>13/2</sub>	4741.343	30	21085.17	212951 <sub>5/2</sub> – 234036° <sub>3/2</sub>
4355.569	100	22952.66	234562° <sub>7/2</sub> – 257514 <sub>7/2</sub>	4745.291	4	21067.63	193520 <sub>7/2</sub> – 214588° <sub>9/2</sub>
4356.079	300	22949.97	237641° <sub>11/2</sub> – 260591 <sub>13/2</sub>	4781.271	30	20909.09	213127 <sub>3/2</sub> – 234036° <sub>3/2</sub>
4356.750	300	22946.44	237644° <sub>9/2</sub> – 260590 <sub>11/2</sub>	4784.813	10	20893.62	195555 <sub>5/2</sub> – 216448° <sub>3/2</sub>
4356.975	3	22945.25		4787.148	5	20883.43	194117 <sub>7/2</sub> – 215000° <sub>7/2</sub>
4358.163	3	22939.00	209875 <sub>5/2</sub> – 232814° <sub>3/2</sub>	4806.435	1	20799.63	
4358.530	10	22937.07		4834.873	3	20677.29	195340 <sub>5/2</sub> – 216017° <sub>7/2</sub>
4360.148	30	22928.56	261169° <sub>13/2</sub> – 254098° <sub>15/2</sub> ?	4839.333	10	20658.23	
4360.346	100	22927.52	261167° <sub>15/2</sub> – 284095 <sub>17/2</sub> ?	4841.423	25	20649.31	194117 <sub>7/2</sub> – 214766° <sub>5/2</sub>
4361.862	15	22919.55	234654° <sub>9/2</sub> – 257574 <sub>9/2</sub>	4856.428	8	20585.52	194117 <sub>7/2</sub> – 214702° <sub>5/2</sub>
4362.735	3	22914.96		4857.135	10	20582.52	
4362.989	10	22913.63	216235 <sub>3/2</sub> – 239148° <sub>5/2</sub>	4863.626	5	20555.05	194033 <sub>11/2</sub> – 214588° <sub>9/2</sub>
4363.244	30	22912.29	211123 <sub>3/2</sub> – 234036° <sub>3/2</sub>	4883.553	30	20471.18	194117 <sub>7/2</sub> – 214588° <sub>9/2</sub>
4364.226	2	22907.13		4885.570	15	20462.73	195555 <sub>5/2</sub> – 216017° <sub>7/2</sub>
4364.565	20	22905.35		4927.410	150	20288.97	220563 <sub>9/2</sub> – 240852° <sub>9/2</sub>
4366.186	200	22896.85	234775° <sub>5/2</sub> – 257671 <sub>5/2</sub>	4928.792	10	20283.28	220569 <sub>7/2</sub> – 240852° <sub>9/2</sub>
4366.690	20	22894.21	234670° <sub>13/2</sub> – 257565 <sub>13/2</sub>	4944.952	120	20217.00	220569 <sub>7/2</sub> – 240786° <sub>7/2</sub>
4367.247	100	22891.29	236511° <sub>7/2</sub> – 259402 <sub>9/2</sub>				

TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (air)	Intensity	Wavenumber	Transition	$\lambda$ (air)	Intensity	Wavenumber	Transition
4946.455	10	20210.86	194117 $7/2$ — 214328° $7/2$	5362.793	5	18641.82	197375 $9/2$ — 216017° $7/2$
4967.901	10	20123.61	196442 $3/2$ — 216565° $5/2$	5364.709	15	18635.16	195722 $1/2$ — 214357° $3/2$
4996.988	5	20006.47	196442 $3/2$ — 216448° $3/2$	5369.794	300	18617.51	197400 $5/2$ — 216017° $7/2$
5001.366	20	19988.96	196028 $9/2$ — 216017° $7/2$	5374.114	20	18602.55	196100 $3/2$ — 214702° $5/2$
5005.202	6	19973.64	213312 $3/2$ — 233285° $5/2$	5376.665	15	18593.72	209875 $5/2$ — 228468° $3/2$
5008.721	4	19959.61	234660° $3/2$ — 254620 $5/2$ ?	5380.443	15	18580.66	212752 $7/2$ — 231333° $5/2$
5020.148	3	19914.18		5380.826	25	18579.34	220569 $7/2$ — 239148° $3/2$
5033.291	40	19862.18	195555 $5/2$ — 215417° $5/2$	5381.044	100	18578.59	220563 $9/2$ — 239142° $11/2$
5045.966	8	19812.29		5386.560	3	18559.56	196028 $9/2$ — 214588° $9/2$
5056.710	2	19770.19		5389.417	25	18549.72	214264 $3/2$ — 232814° $3/2$
5070.133	20	19717.85	196730 $5/2$ — 216448° $3/2$	5389.812	75	18548.37	209875 $5/2$ — 228423° $5/2$
5078.970	10	19683.54	212752 $7/2$ — 232435° $7/2$	5391.703	3	18541.86	
5085.023	15	19660.11	195340 $5/2$ — 215000° $7/2$	5392.431	25	18539.36	195788 $7/2$ — 214328° $7/2$
5085.910	15	19656.69	195343 $7/2$ — 215000° $7/2$	5402.013	15	18506.47	212951 $5/2$ — 231457° $3/2$
5092.762	70	19630.24	209875 $5/2$ — 229505° $3/2$	5402.584	10	18504.52	198061 $5/2$ — 216565° $5/2$
5094.282	400	19624.38	193370 $9/2$ — 212995° $9/2$	5410.669	40	18476.87	220311 $11/2$ — 238788° $9/2$
5124.894	5	19507.16	212951 $5/2$ — 232458° $5/2$	5418.485	350	18450.21	193370 $9/2$ — 211821° $7/2$
5125.476	5	19504.95	193520 $7/2$ — 213025° $5/2$	5422.762	20	18435.66	210033 $3/2$ — 228468° $3/2$
5130.731	150	19484.97	212951 $5/2$ — 232435° $7/2$	5428.839	15	18415.03	198033 $1/2$ — 216448° $3/2$
5133.512	40	19474.42	193520 $7/2$ — 212995° $9/2$	5429.566	5	18412.56	
5134.104	20	19472.17	210033 $3/2$ — 229505° $3/2$	5437.001	3	18387.38	198061 $5/2$ — 216448° $3/2$
5134.606	3	19470.27	213815 $7/2$ — 233285° $3/2$	5438.602	200	18381.97	212951 $5/2$ — 231333° $5/2$
5141.185	20	19445.35	195555 $5/2$ — 215000° $7/2$	5438.602	200	18381.97	194033 $11/2$ — 212415° $9/2$
5147.218	15	19422.56	195343 $7/2$ — 214766° $5/2$	5444.480	2	18362.12	197055 $7/2$ — 215417° $5/2$
5156.097	5	19389.11	214264 $3/2$ — 233653° $3/2$	5447.050	3h	18353.46	
5164.119	15	19358.99	195343 $7/2$ — 214702° $5/2$	5450.455	50	18341.99	194683 $3/2$ — 213025° $5/2$
5168.967	200	19340.84	196442 $3/2$ — 215782° $3/2$	5453.893	10	18330.43	213127 $3/2$ — 231457° $3/2$
5171.584	40	19331.05	213127 $3/2$ — 232458° $5/2$	5455.842	15	18323.88	213133 $5/2$ — 231457° $3/2$
5175.332	2	19317.05	196100 $3/2$ — 215417° $5/2$	5459.735	5	18310.82	
5178.367	1	19305.73		5460.065	15	18309.71	210159 $5/2$ — 228468° $3/2$
5179.271	8	19302.36	213133 $5/2$ — 232435° $7/2$	5462.888	50	18300.25	193520 $7/2$ — 211821° $3/2$
5194.846	15	19244.49	195343 $7/2$ — 214588° $9/2$	5463.161	10	18299.34	196028 $9/2$ — 214328° $7/2$
5198.108	10	19232.41		5463.548	250	18298.04	194117 $7/2$ — 212415° $9/2$
5200.561	150	19223.34	209875 $5/2$ — 229098° $7/2$	5471.976	50	18269.86	220563 $9/2$ — 238833° $7/2$
5200.876	30	19222.18	196795 $9/2$ — 216017° $7/2$	5473.322	0	18265.36	
5203.670	200	19211.86	195788 $7/2$ — 215000° $7/2$	5473.617	2	18264.38	220569 $7/2$ — 238833° $7/2$
5203.839	150	19211.23	195555 $5/2$ — 214766° $5/2$				210159 $5/2$ — 228423° $5/2$
5208.338	400	19194.64	194117 $7/2$ — 213311° $7/2$	5475.494	15	18258.12	196742 $7/2$ — 215000° $7/2$
5216.231	250	19165.59	197400 $5/2$ — 216565° $5/2$	5475.593	5	18257.79	196100 $3/2$ — 214357° $3/2$
5219.213	600	19154.64	193370 $9/2$ — 212525° $11/2$	5477.959	5	18249.99	195061 $9/2$ — 213311° $5/2$
5221.113	80	19147.67	195555 $5/2$ — 214702° $5/2$	5485.687	1	18224.19	220563 $9/2$ — 238788° $9/2$
5221.608	20	19145.86	213312 $3/2$ — 232458° $5/2$	5487.355	50	18218.65	220569 $7/2$ — 238788° $9/2$
5223.070	2	19140.50	193885 $5/2$ — 213025° $5/2$	5491.169	1	18206.00	213127 $3/2$ — 231333° $3/2$
5241.473	15	19073.30		5494.937	250	18193.52	214264 $3/2$ — 232458° $5/2$
5244.986	3	19060.52	196100 $3/2$ — 215160° $1/2$				194331 $13/2$ — 212525° $11/2$
5248.300	150	19048.49	197400 $5/2$ — 216448° $3/2$	5497.951	15	18183.54	210239 $7/2$ — 228423° $5/2$
5249.407	250	19044.47	193370 $9/2$ — 212415° $9/2$	5499.985	50	18176.82	194818 $11/2$ — 212995° $9/2$
5255.753	60	19021.47	214264 $3/2$ — 233285° $5/2$	5516.648	5	18121.92	
5255.960	10	19020.73	210033 $3/2$ — 229054° $1/2$	5520.010	2	18110.88	
5256.834	15	19017.56	195340 $5/2$ — 214357° $3/2$	5520.825	15h	18108.20	
5263.989	5	18991.71	221861 $7/2$ — 240852° $9/2$	5523.027	5	18100.99	
5265.117	5	18987.65	195340 $5/2$ — 214328° $7/2$	5542.045	10	18038.87	
5267.877	30?	18977.70	195788 $7/2$ — 214766° $5/2$	5543.062	15	18035.56	196730 $5/2$ — 214766° $5/2$
5268.588	200	18975.14	196442 $3/2$ — 215417° $5/2$	5544.821	1	18029.84	236590° $3/2$ — 254620 $5/2$ ?
5269.504	10	18971.84	196028 $9/2$ — 215000° $7/2$	5546.619	5	18023.99	196742 $7/2$ — 214766° $5/2$
5272.262	50	18961.91	194033 $11/2$ — 212995° $9/2$	5548.757	3	18017.05	197400 $5/2$ — 215417° $5/2$
5278.538	3	18939.37	210159 $5/2$ — 229098° $7/2$	5552.618	15w	18004.52	
5282.018	100	18926.89	210033 $3/2$ — 228960° $5/2$	5558.267	10	17986.22	213312 $3/2$ — 231298° $1/2$
5283.033	5	18923.25	214730 $1/2$ — 233653° $3/2$	5558.950	2	17984.01	
5285.578	150	18914.14	195788 $7/2$ — 214702° $5/2$	5559.990	3	17980.65	
5287.136	250	18908.57	194117 $7/2$ — 213025° $5/2$	5562.667	0	17972.00	196730 $5/2$ — 214702° $3/2$
5291.071	7	18894.51	193520 $7/2$ — 212415° $9/2$	5562.861	3	17971.37	195340 $5/2$ — 213311° $7/2$
5295.689	200	18878.03	194117 $7/2$ — 212995° $9/2$	5563.904	30	17968.00	195343 $7/2$ — 213311° $7/2$
5301.165	15	18858.53	210239 $7/2$ — 229098° $7/2$	5566.035	10	17961.12	197199 $1/2$ — 215160° $1/2$
5309.107	100	18830.32	195757 $11/2$ — 214588° $9/2$	5566.258	25	17960.40	196742 $7/2$ — 214702° $5/2$
5314.957	10	18809.59	195518 $9/2$ — 214328° $7/2$	5570.945	20	17945.29	197055 $7/2$ — 215000° $7/2$
5316.862	150	18802.86	195555 $5/2$ — 214357° $3/2$	5571.920	3	17942.15	
5317.778	400	18799.62	195788 $7/2$ — 214588° $9/2$	5573.938	50	17935.66	193885 $5/2$ — 211821° $7/2$
5325.344	250	18772.91	195555 $5/2$ — 214328° $7/2$	5574.680	5	17933.27	195061 $9/2$ — 212995° $9/2$
5337.864	75	18728.88	220413 $13/2$ — 239142° $11/2$	5575.634	10	17930.20	211123 $3/2$ — 229054° $5/2$
5340.362	2	18720.12	210239 $7/2$ — 228960° $5/2$	5580.05	1	17916.01	196442 $3/2$ — 214357° $3/2$
5340.798	60	18718.59	196442 $3/2$ — 215160° $1/2$	5586.11	1	17896.58	196806 $3/2$ — 214702° $5/2$
5356.064	20	18665.24	197900 $5/2$ — 216565° $5/2$	5587.837	5	17891.04	216145 $5/2$ — 234036° $3/2$



TABLE 1. *Observed lines of Cu III—Continued*

$\lambda$ (air)	Intensity	Wavenumber	Transition	$\lambda$ (air)	Intensity	Wavenumber	Transition
5590.526	10	17882.44	197900 $\frac{5}{2}$ – 215782° $\frac{3}{2}$	5814.720	3	17192.97	214264 $\frac{3}{2}$ – 231457° $\frac{3}{2}$
5591.179	5h	17880.35	213418 $\frac{1}{2}$ – 231298° $\frac{1}{2}$	5818.140	10	17182.86	211286 $\frac{1}{2}$ – 228468° $\frac{3}{2}$
5597.190	2	17861.15		5820.763	100	17175.12	197985 $\frac{3}{2}$ – 215160° $\frac{1}{2}$
5598.120	3	17858.18		5821.58	2	17172.71	197593 $\frac{7}{2}$ – 214766° $\frac{5}{2}$
5599.646	5	17853.31	211652 $\frac{3}{2}$ – 229505° $\frac{3}{2}$	5828.55	30	17152.17	211271 $\frac{7}{2}$ – 228423° $\frac{5}{2}$
5601.900	2	17846.13	215807 $\frac{3}{2}$ – 233653° $\frac{3}{2}$	5837.05	0	17127.19	198033 $\frac{1}{2}$ – 215160° $\frac{1}{2}$
5603.278	5	17841.74		5846.32	5	17100.04	197900 $\frac{5}{2}$ – 215000° $\frac{7}{2}$
5604.96	1	17836.39	211123 $\frac{3}{2}$ – 228960° $\frac{5}{2}$ ?	5847.29	2h	17097.20	
5607.410	2	17828.60		5850.72	100	17087.18	198930 $\frac{7}{2}$ – 216017° $\frac{7}{2}$
5608.315	10	17825.72	211679 $\frac{5}{2}$ – 229505° $\frac{3}{2}$	5856.13	50	17071.39	195343 $\frac{7}{2}$ – 212415° $\frac{9}{2}$
5609.001	100	17823.54	197593 $\frac{7}{2}$ – 215417° $\frac{5}{2}$	5867.85	3	17037.29	
5610.517	15	17818.72		5878.32	5h	17006.95	195518 $\frac{9}{2}$ – 212525° $\frac{11}{2}$
5617.246	10	17797.38	197985 $\frac{3}{2}$ – 215782° $\frac{3}{2}$				215807 $\frac{3}{2}$ – 232814° $\frac{3}{2}$
5618.526	50	17793.32	195518 $\frac{9}{2}$ – 213311° $\frac{7}{2}$	5890.22	15	16972.59	221861 $\frac{7}{2}$ – 238833° $\frac{7}{2}$
5618.701	0	17792.77	196795 $\frac{9}{2}$ – 214588° $\frac{9}{2}$	5892.36	30	16966.43	196028 $\frac{9}{2}$ – 212995° $\frac{9}{2}$
5621.237	50	17784.74	211313 $\frac{9}{2}$ – 229098° $\frac{7}{2}$	5895.32	30	16957.91	197400 $\frac{5}{2}$ – 214357° $\frac{3}{2}$
5622.78	1	17779.86		5901.82	3	16939.23	198061 $\frac{5}{2}$ – 215000° $\frac{7}{2}$
5628.116	2	17763.00	223089 $\frac{9}{2}$ – 240852° $\frac{9}{2}$	5905.78	10	16927.87	197400 $\frac{5}{2}$ – 214328° $\frac{7}{2}$
5628.336	1	17762.31		5909.73	10	16916.56	
5630.125	5	17756.67	195555 $\frac{5}{2}$ – 213311° $\frac{7}{2}$	5916.71	75	16896.60	195518 $\frac{9}{2}$ – 212415° $\frac{9}{2}$
5636.900	5	17735.32	237751° $\frac{7}{2}$ – 255486 $\frac{7}{2}$	5948.37	1	16806.67	
5637.691	5	17732.84		5949.93	50	16802.27	197900 $\frac{5}{2}$ – 214702° $\frac{5}{2}$
5641.230	20	17721.71	198061 $\frac{5}{2}$ – 215782° $\frac{3}{2}$	5960.82	10	16771.57	211652 $\frac{3}{2}$ – 228423° $\frac{5}{2}$
5643.747	3	17713.81	215100 $\frac{5}{2}$ – 232814° $\frac{3}{2}$	5962.29	5	16767.43	195757 $\frac{11}{2}$ – 212525° $\frac{11}{2}$
5644.595	30	17711.15	197055 $\frac{7}{2}$ – 214766° $\frac{3}{2}$	5965.25	200	16759.11	195061 $\frac{9}{2}$ – 211821° $\frac{7}{2}$
5645.925	50	17706.97	194818 $\frac{11}{2}$ – 212525° $\frac{11}{2}$	5970.68	5	16743.87	211679 $\frac{5}{2}$ – 228423° $\frac{5}{2}$
5649.232	10	17696.61	223089 $\frac{9}{2}$ – 240786° $\frac{7}{2}$	5974.06	15	16734.40	197593 $\frac{7}{2}$ – 214328° $\frac{7}{2}$
5651.762	20	17688.69	211271 $\frac{7}{2}$ – 228960° $\frac{5}{2}$	5980.18	5	16717.27	197985 $\frac{7}{2}$ – 214702° $\frac{5}{2}$
5652.001	30	17687.94	214747 $\frac{9}{2}$ – 232435° $\frac{7}{2}$	5984.53	15	16705.12	198061 $\frac{5}{2}$ – 214766° $\frac{5}{2}$
5652.847	20	17685.29	195340 $\frac{5}{2}$ – 213025° $\frac{5}{2}$	5997.40	1	16669.27	216145 $\frac{5}{2}$ – 232814° $\frac{3}{2}$
5653.923	10	17681.93	195343 $\frac{7}{2}$ – 213025° $\frac{5}{2}$	5998.99	5	16664.86	
5655.292	10	17677.65	223175 $\frac{11}{2}$ – 240852° $\frac{9}{2}$	6001.72	50	16657.28	195757 $\frac{11}{2}$ – 212415° $\frac{9}{2}$
5663.529	10	17651.94	223200 $\frac{9}{2}$ – 240852° $\frac{9}{2}$	6007.34	5	16641.69	198061 $\frac{5}{2}$ – 214702° $\frac{5}{2}$
5668.876	50	17635.29	198930 $\frac{7}{2}$ – 216565° $\frac{5}{2}$	6012.79	3	16626.61	195788 $\frac{7}{2}$ – 212415° $\frac{9}{2}$
5671.494	10	17627.15	196730 $\frac{5}{2}$ – 214357° $\frac{3}{2}$	6029.30	30	16581.03	196730 $\frac{5}{2}$ – 213311° $\frac{7}{2}$ ?
5672.310	50	17624.61	197375 $\frac{9}{2}$ – 215000° $\frac{7}{2}$	6030.04	2h	16579.05	216235 $\frac{3}{2}$ – 232814° $\frac{3}{2}$
5676.005	30	17613.14	214844 $\frac{7}{2}$ – 232458° $\frac{5}{2}$	6033.45	15	16569.68	196742 $\frac{7}{2}$ – 213311° $\frac{7}{2}$
5676.329	5	17612.13	223174 $\frac{7}{2}$ – 240786° $\frac{7}{2}$	6060.14	1	16496.70	196028 $\frac{9}{2}$ – 212525° $\frac{11}{2}$
5680.160	1	17600.25	197400 $\frac{5}{2}$ – 215000° $\frac{7}{2}$	6063.29	0	16488.13	214844 $\frac{7}{2}$ – 231333° $\frac{5}{2}$
5681.262	30	17596.84	194818 $\frac{11}{2}$ – 212415° $\frac{9}{2}$	6063.77	1	16486.83	198930 $\frac{7}{2}$ – 215417° $\frac{5}{2}$
5684.886	20	17585.62	196742 $\frac{7}{2}$ – 214328° $\frac{7}{2}$	6066.07	30	16480.57	195340 $\frac{5}{2}$ – 211821° $\frac{7}{2}$
			223200 $\frac{9}{2}$ – 240786° $\frac{7}{2}$	6067.30	10	16477.23	195343 $\frac{7}{2}$ – 211821° $\frac{7}{2}$
			197038 $\frac{11}{2}$ – 214588° $\frac{9}{2}$	6070.73	1	16467.92	214989 $\frac{5}{2}$ – 231457° $\frac{3}{2}$
5696.563	150	17549.58		6076.43	2	16452.48	
5700.593	5	17537.17		6085.63	3	16427.60	197900 $\frac{5}{2}$ – 214328° $\frac{7}{2}$
5702.116	75	17532.48	196795 $\frac{9}{2}$ – 214328° $\frac{7}{2}$	6095.30	15	16401.54	
5705.140	3	17523.19	195788 $\frac{7}{2}$ – 213311° $\frac{7}{2}$	6095.64	20	16400.63	122860 $\frac{1}{2}$ – 139261° $\frac{1}{2}$
5707.251	15	17516.71	197900 $\frac{5}{2}$ – 215417° $\frac{5}{2}$	6100.87	30	16386.57	196028 $\frac{9}{2}$ – 212415° $\frac{9}{2}$
5716.420	20	17488.61	214989 $\frac{5}{2}$ – 232478° $\frac{3}{2}$	6106.13	15	16372.45	197985 $\frac{3}{2}$ – 214357° $\frac{3}{2}$
5720.313	30	17476.71	195518 $\frac{9}{2}$ – 212995° $\frac{9}{2}$	6111.85	1	16357.13	215100 $\frac{5}{2}$ – 231457° $\frac{3}{2}$
5722.340	1	17470.52	195555 $\frac{5}{2}$ – 213025° $\frac{5}{2}$	6132.31	30	16302.56	195518 $\frac{9}{2}$ – 211821° $\frac{7}{2}$
5722.990	2	17468.54	214989 $\frac{5}{2}$ – 232458° $\frac{5}{2}$	6134.51	20	16296.71	198061 $\frac{5}{2}$ – 214357° $\frac{3}{2}$
5724.651	10	17463.47	195061 $\frac{9}{2}$ – 212525° $\frac{11}{2}$	6135.16	10	16294.98	196730 $\frac{5}{2}$ – 213025° $\frac{5}{2}$
5735.070	2	17431.74	197985 $\frac{3}{2}$ – 215417° $\frac{5}{2}$	6145.79	5	16266.80	198061 $\frac{5}{2}$ – 214328° $\frac{7}{2}$
5736.830	2	17426.40		6173.75	1	16193.13	213312 $\frac{3}{2}$ – 229505° $\frac{3}{2}$
5739.440	3	17418.47	216235 $\frac{3}{2}$ – 233653° $\frac{3}{2}$ ?	6227.78	1	16052.65	223089 $\frac{9}{2}$ – 239142° $\frac{11}{2}$
			211679 $\frac{5}{2}$ – 229098° $\frac{7}{2}$ ?	6235.66	2	16032.36	195788 $\frac{7}{2}$ – 211821° $\frac{7}{2}$
5760.050	10	17356.15	198061 $\frac{5}{2}$ – 215417° $\frac{5}{2}$	6251.94	2	15990.61	213514 $\frac{3}{2}$ – 229505° $\frac{3}{2}$
5760.987	75	17353.32	195061 $\frac{9}{2}$ – 212415° $\frac{9}{2}$	6255.80	2h	15980.75	216833 $\frac{1}{2}$ – 232814° $\frac{3}{2}$
5763.790	5	17344.88	211123 $\frac{3}{2}$ – 228468° $\frac{3}{2}$	6258.23	15	15974.54	223174 $\frac{7}{2}$ – 239148° $\frac{5}{2}$
5764.848	0	17341.70		6259.80	20	15970.53	197055 $\frac{7}{2}$ – 213025° $\frac{5}{2}$
5765.091	5	17340.97	122860 $\frac{1}{2}$ – 140201° $\frac{3}{2}$	6261.08	30	15967.27	223175 $\frac{11}{2}$ – 239142° $\frac{11}{2}$
5768.564	100	17330.53	198687 $\frac{9}{2}$ – 216017° $\frac{7}{2}$	6265.28	10	15956.56	197038 $\frac{11}{2}$ – 212995° $\frac{9}{2}$
5775.730	15	17309.03	215976 $\frac{7}{2}$ – 233285° $\frac{5}{2}$	6270.31	1	15943.76	
5783.110	3	17286.94		6271.17	15	15941.58	223200 $\frac{9}{2}$ – 239142° $\frac{11}{2}$
5784.400	10	17283.08	196028 $\frac{9}{2}$ – 213311° $\frac{7}{2}$	6316.40	2	15827.43	
5785.310	2	17280.37	211679 $\frac{5}{2}$ – 228960° $\frac{5}{2}$	6330.41	5	15792.40	196028 $\frac{9}{2}$ – 211821° $\frac{7}{2}$
5788.830	2	17269.86	221878 $\frac{5}{2}$ – 239148° $\frac{5}{2}$	6349.91	3	15743.90	223089 $\frac{9}{2}$ – 238833° $\frac{7}{2}$
5797.775	10	17243.21	224450° $\frac{7}{2}$ – 241693 $\frac{5}{2}$	6360.33	2	15718.11	197593 $\frac{7}{2}$ – 213311° $\frac{7}{2}$
5799.819	75	17237.14	195788 $\frac{7}{2}$ – 213025° $\frac{5}{2}$	6368.35	30	15698.31	223089 $\frac{9}{2}$ – 238788° $\frac{9}{2}$
			195757 $\frac{11}{2}$ – 212995° $\frac{9}{2}$	6369.27	50	15696.05	215761 $\frac{1}{2}$ – 231457° $\frac{3}{2}$
5802.320	5	17229.71		6383.30	3	15661.55	
5808.152	50	17212.41	197375 $\frac{9}{2}$ – 214588° $\frac{9}{2}$	6383.64	1	15660.71	
5810.155	10	17206.47	195788 $\frac{7}{2}$ – 212995° $\frac{9}{2}$				



TABLE 1. Observed lines of Cu III—Continued

$\lambda$ (air)	Intensity	Wavenumber	Transition	$\lambda$ (air)	Intensity	Wavenumber	Transition
6387.87	3	15650.34	215807 $^{3/2}$ — 231457° $^{3/2}$	6541.47	1	15282.86	213815 $^{7/2}$ — 229098° $^{7/2}$
6391.69	15	15640.99	198687 $^{9/2}$ — 214328° $^{7/2}$	6582.32	10	15188.02	216145 $^{5/2}$ — 231333° $^{5/2}$
6395.00	20	15632.89	223200 $^{9/2}$ — 238833° $^{7/2}$	6595.93	1	15156.68	213312 $^{1/2}$ — 228468° $^{3/2}$
6397.98	2	15625.61	197400 $^{5/2}$ — 213025° $^{5/2}$	6615.73	2	15111.32	
6402.79	15	15613.88	223174 $^{7/2}$ — 238788° $^{9/2}$	6628.94	1	15081.20	216376 $^{5/2}$ — 231457° $^{3/2}$
6431.58	15	15543.98		6644.13	20	15046.72	223787 $^{5/2}$ — 238833° $^{7/2}$
6439.13	10	15525.76	215807 $^{3/2}$ — 231333° $^{5/2}$	6739.57	30	14833.65	201732 $^{3/2}$ — 216565° $^{5/2}$
6472.64	1	15445.38	213514 $^{3/2}$ — 228960° $^{5/2}$	6753.65	20	14802.72	201215 $^{5/2}$ — 216017° $^{7/2}$
6478.19	1	15432.15	226857° $^{5/2}$ — 242290 $^{5/2}$	6776.61	1	14752.57	
6501.58	15	15376.63	197038 $^{11/2}$ — 212415° $^{9/2}$	6793.20	50	14716.54	201732 $^{3/2}$ — 216448° $^{3/2}$
6508.61	2	15360.02	197055 $^{7/2}$ — 212415° $^{9/2}$	6826.29	10	14645.20	224503 $^{3/2}$ — 239148° $^{5/2}$
6512.54	20	15350.75	201215 $^{5/2}$ — 216565° $^{5/2}$	6831.58	1	14633.86	240852° $^{9/2}$ — 255486 $^{7/2}$
6528.82	2	15312.47	216145 $^{5/2}$ — 231457° $^{3/2}$	6851.62	3	14591.06	

<sup>a</sup> Partly second order.<sup>b</sup> Partly Cu II.

TABLE 2. Observed terms of Cu III

Configuration	Observed terms				
$3d^9$ $3d^7 4s^2$	$3d^2 D$ $s^2 4F^2 G^2 H^2 F$				
	$ns (n \geq 4)$	$np (n \geq 4)$	$nd (n \geq 4)$	$nf (n \geq 4)$	$ng (n \geq 5)$
$3d^8(^3F)nx$	$4s$ to $7s^4$ & $2 F$	$4p$ & $5p^4$ & $2 DFG$	$4d$ to $5d^4$ & $2 PDFGH$	$4f^4$ & $2 SPDFGHI$	$5g^4$ & $2 PDFGHIK$
$3d^8(^1D)nx$	$4s'$ to $6s'$ $^2D$	$4p'$ & $5p'$ $^2PDF$	$4d'$ to $5d'$ $^2SPDFG$	$4f'$ $^2DFGH$	$5g'$ $^2GHI$
$3d^8(^3P)nx$	$4s''$ to $6s''^4$ & $2 P$	$4p''$ & $5p''^4$ & $2 SPD$	$4d''$ to $5d''^4$ & $2 PDF$	$4f''^4 DFG^2 G$	
$3d^8(^1G)nx$	$4s'''$ to $6s'''^2 G$	$4p'''$ & $5p'''^2 FGH$	$4d'''$ to $5d'''^2 DFGHI$	$4f'''^2 GHIK$	$5g'''^2 L$
$3d^8(^1S)nx$	$4s^{IV} 2S$	$4p^{IV} 2P$			
$3d^7(^4F)4s4p(^3P)$		$z^4 DFG^2 D$			
$3d^7(^4F)4s4p(^1P)$		$x^4 DFG$			
$3d^7(^2G)4s4p(^3P)$		$y^4 F_{41/2}$			
$3d^7(^2P)4s4p(^3P)$		$w^4 D$			
$3d^7(^2H)4s4p(^3P)$		$w^4 G$			
$3d^7(^2D)4s4p(^3P)$		$v^4 D$ & $w^4 F$			
$3d^7 4s4p$		$1^\circ$ to $7^\circ$			

of a level is reduced in most cases to just two, a very strong one for which both  $\Delta L$  and  $\Delta J$  are in the same direction as  $\Delta l$ , and a second much weaker line for which  $\Delta L$  and  $\Delta J$  are zero. The result is that many levels must be represented by just one combination and consequently there is no real evidence for choosing them.

### 3. Differences Between Observed and Calculated Levels

Among the low even levels,  $4s''^4 P_{1/2}$ ,  $4P_{1/2}$ ,  $2P_{11/2}$ ,  $2P_{1/2}$  all differ by over  $100 \text{ cm}^{-1}$  from the calculated positions, but there can be no doubt of the experimental values.  $4s^{IV} 2S$  is  $536 \text{ cm}^{-1}$  below the calculated value but, again, the evidence is conclusive.

The  $s^2 2F_{21/2}$  level mentioned above is  $497 \text{ cm}^{-1}$  too high, and the  $4d'^2 F_{21/2}$  is  $202 \text{ cm}^{-1}$  too low. Although those two levels are  $4500 \text{ cm}^{-1}$  apart, I suggest that the deviations from theory may be due to their mutual repulsion.

After the  $4f$  levels were identified there remained in the same part of the spectrum a considerable number

of strong lines which had to be due to transitions between the  $4d$  and  $4f$  configurations, but there did not appear to be much agreement between them and the theoretical predictions. Accordingly, I tried for levels which might be about  $300 \text{ cm}^{-1}$  from the predicted values. That led to the definite identification of five  $4f'$  levels and two less certain ones. There still remained some of the strongest lines and several of them appeared in pairs. Ignoring the calculations, I tried the strongest pair as the diagonals of the multiplet  $4d'''^2 I - 4f'''^2 K$  and found two levels very close together, as they should be. The next two strongest lines were then assumed to be  $4d'''^2 H - 4f'''^2 I$ , and I found two levels  $8 \text{ cm}^{-1}$  apart. The reality of the levels was confirmed by two additional combinations of  $4f'''^2 I_{51/2}$ . Continuing the analysis by this method, I found  $4f'''^2 H$ ,  $2G$ , and  $2F_{31/2}$  with sufficient combinations to confirm the whole set. The differences between observed and calculated values were very large,<sup>3</sup> ranging from  $+1366$  to  $+1512 \text{ cm}^{-1}$ . Having eliminated from consideration most of the strong lines as due to

<sup>3</sup> These large deviations of the predicted levels have since been corrected by the addition of effective interactions to the matrices for this configuration [8].

$4f'''$ , I then found it possible to identify with some certainty ten  $4f''$  levels with differences from predicted values from  $-181$  to  $+121$ . It should be noticed that the differences for the  $4f'$  and  $4f'''$  levels were of opposite sign. None of the levels combines with any level except those of its own family or with  $s^2\ ^2F$ , which is very much mixed with the  $4d''$  levels.

The  $5g$  levels produced a considerable number of diffuse lines in the region of  $22,500$  to  $23,000\text{ cm}^{-1}$ , which are very difficult to measure. I have found it possible, however, to identify 31 of the 41 levels based on  $^3F$  with some certainty. From the remaining lines it was possible to make a definite identification of  $5g'\ ^2G$  and tentative identifications of  $5g'\ ^2I$  and  $5g'\ ^2H$ . A possible  $5g'''\ ^2L$  is also given in table 3.

TABLE 3. *Even levels of Cu III*

Configuration	Name	Level ( $\text{cm}^{-1}$ )
$3d^9$	$3d\ ^2D_{2\frac{1}{2}}$	0.00
	$3d\ ^2D_{1\frac{1}{2}}$	2071.69
$3d^8(^3F_4)4s$	$4s\ ^4F_{4\frac{1}{2}}$	60805.22
	$4s\ ^4F_{3\frac{1}{2}}$	62065.09
$3d^8(^3F_3)4s$	$4s\ ^4F_{2\frac{1}{2}}$	63143.77
$3d^8(^3F_2)4s$	$4s\ ^4F_{1\frac{1}{2}}$	63886.51
$3d^8(^3F_3)4s$	$4s\ ^2F_{3\frac{1}{2}}$	67016.71
$3d^8(^3F_2)4s$	$4s\ ^2F_{2\frac{1}{2}}$	68963.78
$3d^8(^1D)4s$	$4s'\ ^2D_{2\frac{1}{2}}$	77968.25
	$4s'\ ^2D_{1\frac{1}{2}}$	78780.00
$3d^8(^3P)4s$	$4s''\ ^4P_{1\frac{1}{2}}$	80305.74
	$4s''\ ^4P_{1\frac{1}{2}}$	80423.54
	$4s''\ ^4P_{1\frac{1}{2}}$	80552.14
	$4s''\ ^2P_{1\frac{1}{2}}$	85447.29
	$4s''\ ^2P_{1\frac{1}{2}}$	86133.66
$3d^8(^1G)4s$	$4s'''\ ^2G_{4\frac{1}{2}}$	89018.30
	$4s'''\ ^2G_{3\frac{1}{2}}$	89046.71
$3d^8(^1S)4s$	$4s^{IV}\ ^2S_{1\frac{1}{2}}$	122860.82
$3d^74s^2$	$4s^2\ ^4F_{4\frac{1}{2}}$	166159.36
	$4s^2\ ^4F_{3\frac{1}{2}}$	167739.09
	$4s^2\ ^4F_{2\frac{1}{2}}$	168856.96
	$4s^2\ ^4F_{1\frac{1}{2}}$	169608.26
	$4s^2\ ^2G_{4\frac{1}{2}}$	188097.72
	$4s^2\ ^2G_{3\frac{1}{2}}$	189602.62
$3d^8(^3F_4)5s$	$5s\ ^4F_{4\frac{1}{2}}$	193370.76
$3d^8(^3F_4)4d$	$4d\ ^4D_{3\frac{1}{2}}$	193520.75
	$4d\ ^4P_{2\frac{1}{2}}$	193885.30
	$4d\ ^4H_{5\frac{1}{2}}$	194033.26
$3d^8(^3F_4)5s$	$5s\ ^4F_{3\frac{1}{2}}$	194117.14
$3d^8(^3F_4)4d$	$4d\ ^4H_{6\frac{1}{2}}$	194331.79
	$4d\ ^4P_{1\frac{1}{2}}$	194683.69
	$4d\ ^4G_{5\frac{1}{2}}$	194818.37
	$4d\ ^4F_{4\frac{1}{2}}$	195061.88
	$4d\ ^4D_{2\frac{1}{2}}$	195340.40
	$4d\ ^4F_{3\frac{1}{2}}$	195343.79
	$4d\ ^4G_{4\frac{1}{2}}$	195518.43
$3d^8(^3F_3)5s$	$5s\ ^4F_{2\frac{1}{2}}$	195555.12
$3d^8(^3F_3)4d$	$4d\ ^4P_{1\frac{1}{2}}$	195722.78
$3d^74s^2$	$4s^2\ ^2H_{5\frac{1}{2}}$	195757.94
$3d^8(^3F_3)5s$	$5s\ ^2F_{3\frac{1}{2}}$	195788.65
$3d^8(^3F_3)4d$	$4d\ ^4H_{4\frac{1}{2}}$	196028.66
	$4d\ ^2P_{1\frac{1}{2}}$	196100.20
$3d^8(^3F_2)5s$	$5s\ ^4F_{1\frac{1}{2}}$	196442.14
$3d^8(^3F_3)4d$	$4d\ ^4F_{2\frac{1}{2}}$	196730.75
	$4d\ ^4G_{3\frac{1}{2}}$	196742.34
$3d^74s^2$	$4s^2\ ^2H_{4\frac{1}{2}}$	196795.53
$3d^8(^3F_3)4d$	$4d\ ^4D_{1\frac{1}{2}}$	196806.22
	$4d\ ^2H_{5\frac{1}{2}}$	197038.62
	$4d\ ^2F_{3\frac{1}{2}}$	197055.18
$3d^8(^3F_2)4d$	$4d\ ^4D_{1\frac{1}{2}}$	197199.63
$3d^8(^3F_3)4d$	$4d\ ^2G_{4\frac{1}{2}}$	197375.85

TABLE 3. *Even levels of Cu III—Continued*

Configuration	Name	Level ( $\text{cm}^{-1}$ )
$3d^8(^3F_2)5s$	$5s\ ^2F_{2\frac{1}{2}}$	197400.19
$3d^8(^3F_2)4d$	$4d\ ^4H_{3\frac{1}{2}}$	197593.69
	$4d\ ^4G_{2\frac{1}{2}}$	197900.51
	$4d\ ^4F_{1\frac{1}{2}}$	197985.57
	$4d\ ^2P_{1\frac{1}{2}}$	198033.60
	$4d\ ^2F_{2\frac{1}{2}}$	198061.23
	$4d\ ^2H_{4\frac{1}{2}}$	198687.18
	$4d\ ^2G_{3\frac{1}{2}}$	198930.42
$3d^8(^3F_3)4d$	$4d\ ^2D_{2\frac{1}{2}}$	201215.00
$3d^8(^3F_2)4d$	$4d\ ^2D_{1\frac{1}{2}}$	201732.15
$3d^8(^1D)5s$	$5s'\ ^2D_{2\frac{1}{2}}$	209875.15
	$5s'\ ^2D_{1\frac{1}{2}}$	210033.19
$3d^8(^1D)4d$	$4d'\ ^2F_{2\frac{1}{2}}$	210159.14
	$4d'\ ^2F_{3\frac{1}{2}}$	210239.88
	$4d'\ ^2D_{1\frac{1}{2}}$	211123.91
	$4d'\ ^2G_{3\frac{1}{2}}$	211271.32
	$4d'\ ^2P_{1\frac{1}{2}}$	211286.05
	$4d'\ ^2G_{4\frac{1}{2}}$	211313.62
	$4d'\ ^2P_{1\frac{1}{2}}$	211652.05
	$4d'\ ^2D_{2\frac{1}{2}}$	211679.61
	$4d'\ ^2S_{1\frac{1}{2}}$	212208.63
$3d^8(^3P)4d$	$4d''\ ^4D_{3\frac{1}{2}}$	212752.39
$3d^8(^3P)5s$	$5s''\ ^4P_{2\frac{1}{2}}$	212951.03
	$5s''\ ^4P_{1\frac{1}{2}}$	213127.07
$3d^8(^3P)4d$	$4d''\ ^4D_{2\frac{1}{2}}$	213133.65
	$4d''\ ^4D_{1\frac{1}{2}}$	213141.65
	$4d''\ ^4D_{1\frac{1}{2}}$	213312.19
$3d^8(^3P)5s$	$5s''\ ^4P_{1\frac{1}{2}}$	213418.17
$3d^74s^2$	$4s^2\ ^2F_{2\frac{1}{2}}$	213514.78
	$4s^2\ ^2F_{3\frac{1}{2}}$	213815.69
$3d^8(^3P)5s$	$5s''\ ^2P_{1\frac{1}{2}}$	214264.50
	$5s''\ ^2P_{1\frac{1}{2}}$	214730.18
$3d^8(^3P)4d$	$4d''\ ^4F_{4\frac{1}{2}}$	214747.99
	$4d''\ ^4F_{3\frac{1}{2}}$	214844.87
	$4d''\ ^4F_{2\frac{1}{2}}$	214989.62
	$4d''\ ^2D_{2\frac{1}{2}}$	215100.44
	$4d''\ ^4F_{1\frac{1}{2}}$	215197.18
	$4d''\ ^4P_{1\frac{1}{2}}$	215761.54
	$4d''\ ^4P_{1\frac{1}{2}}$	215807.35
	$4d''\ ^2F_{3\frac{1}{2}}$	215976.94
	$4d''\ ^4P_{2\frac{1}{2}}$	216145.05
	$4d''\ ^2D_{1\frac{1}{2}}$	216235.32
	$4d''\ ^2F_{2\frac{1}{2}}$	216376.27
	$4d''\ ^2P_{1\frac{1}{2}}$	216833.51
$3d^8(^1G)4d$	$4d'''\ ^2D_{5\frac{1}{2}}$	220311.20
	$4d'''\ ^2I_{6\frac{1}{2}}$	220413.54
$3d^8(^1G)5s$	$5s'''\ ^2G_{4\frac{1}{2}}$	220563.89
	$5s'''\ ^2G_{3\frac{1}{2}}$	220569.48
$3d^8(^1G)4d$	$4d'''\ ^2F_{3\frac{1}{2}}$	221861.15
	$4d'''\ ^2F_{2\frac{1}{2}}$	221878.97
	$4d'''\ ^2H_{4\frac{1}{2}}$	223089.88
	$4d'''\ ^2G_{3\frac{1}{2}}$	223174.34
	$4d'''\ ^2H_{5\frac{1}{2}}$	223175.15
	$4d'''\ ^2G_{4\frac{1}{2}}$	223200.87
	$4d'''\ ^2D_{2\frac{1}{2}}$	223787.07
	$4d'''\ ^2D_{1\frac{1}{2}}$	224503.61
$3d^8(^3F_4)6s$	$6s\ ^4F_{4\frac{1}{2}}$	238280.09
	$6s\ ^4F_{3\frac{1}{2}}$	238638.49
$3d^8(^3F_4)5d$	$5d\ ^4F_{3\frac{1}{2}}$	238730.93
	$5d\ ^4P_{2\frac{1}{2}}$	238818.98
	$5d\ ^4H_{6\frac{1}{2}}$	238994.08
	$5d\ ^4H_{5\frac{1}{2}}$	239112.04
	$5d\ ^4G_{5\frac{1}{2}}$	239240.10
	$5d\ ^4F_{4\frac{1}{2}}$	239290.03
	$5d\ ^4P_{1\frac{1}{2}}$	239326.97
	$5d\ ^4F_{3\frac{1}{2}}$	239440.71
	$5d\ ^4G_{4\frac{1}{2}}$	239568.88
	$5d\ ^4D_{2\frac{1}{2}}$	240062.88
$3d^8(^3F_3)6s$	$6s\ ^2F_{3\frac{1}{2}}$	240303.20
	$6s\ ^4F_{2\frac{1}{2}}$	240325.65
$3d^8(^3F_3)5d$	$5d\ ^4P_{1\frac{1}{2}}$	240764.06

TABLE 3. Even levels of Cu III—Continued

Configuration	Name	Level (cm <sup>-1</sup> )
$3d^8(^3F_3)5d$	$5d$ $^2P_{1/2}$	240794.56
	$5d$ $^2H_{5/2}$	240960.52
	$5d$ $^4H_{4/2}$	240972.55
	$5d$ $^4F_{2/2}$	240994.59
	$5d$ $^2F_{3/2}$	241074.10
	$5d$ $^2G_{4/2}$	241215.61
	$5d$ $^4G_{3/2}$	241249.83
	$6s$ $^4F_{1/2}$	241328.02
	$5d$ $^4D_{1/2}$	241391.60
	$6s$ $^2F_{2/2}$	241693.54
$3d^8(^3F_2)6s$	$5d$ $^4D_{1/2}$	241899.60
$3d^8(^3F_3)5d$	$5d$ $^2F_{2/2}$	242006.56
$3d^8(^3F_2)6s$	$5d$ $^4H_{3/2}$	242088.67
$3d^8(^3F_2)5d$	$5d$ $^4F_{1/2}$	242219.08
$3d^8(^1D)6s$	$5d$ $^2P_{1/2}$	242247.32
$3d^8(^1D)5d$	$5d$ $^4G_{2/2}$	242290.02
	$5d$ $^2H_{4/2}$	242297.51
	$5d$ $^2G_{3/2}$	242610.05
	$5d$ $^2D_{2/2}$	243780.33
	$5d$ $^2D_{1/2}$	244618.53
	$6s'$ $^2D_{2/2}$	254620.28
	$6s'$ $^2D_{1/2}$	254694.27
	$5d'$ $^2F_{3/2}$	255173.30
	$5d'$ $^2G_{4/2}$	255458.91 ?
	$5d'$ $^2G_{3/2}$	255486.66 ?
$3d^8(^3F_4)5g$	$5d'$ $^2P_{1/2}$	255750.15
	$5d'$ $^2D_{2/2}$	256093.09 ?
	$5g$ $^4P_{2/2}$	257488.98
	$5g$ $^4P_{1/2}$	257495.26
	$5g$ $^4K_{7/2}$	257504.55
	$5g$ $^4K_{8/2}$	257504.70
	$5g$ $^4D_{3/2}$	257514.75
	$5g$ $^4G_{5/2}$	257530.89
	$5g$ $^4I_{6/2}$	257540.31
	$5g$ $^4I_{7/2}$	257540.49
$3d^8(^3P)6s$	$5g$ $^4H_{5/2}$	257566.45
	$5g$ $^4H_{6/2}$	257565.23
	$5g$ $^4F_{4/2}$	257574.15 ?
	$5g$ $^4P_{1/2}$	257602.70
	$5g$ $^4G_{4/2}$	257625.54
	$5g$ $^4F_{3/2}$	257668.09 ?
	$5g$ $^4D_{2/2}$	257671.85
	$6s''$ $^4P_{2/2}$	257885.87
	$5d''$ $^4D_{3/2}$	258199.34 ?
	$5d''$ $^4F_{4/2}$	258855.31 ?
$3d^8(^3P)5d$	$5d''$ $^4F_{3/2}$	259018.09 ?
$3d^8(^3F_4)7s$	$7s$ $^4F_{4/2}$	259147.46 ?
	$5g$ $^4K_{6/2}$	259371.79
	$5g$ $^2K_{7/2}$	259372.09
	$5g$ $^4H_{4/2} ?$	259402.75 ?
	$5g$ $^2G_{4/2} ?$	259402.75
	$5g$ $^4I_{5/2}$	259404.25
	$5g$ $^2I_{6/2}$	259404.43
	$5g$ $^2H_{5/2}$	259417.64
	$5g$ $^2P_{1/2}$	259432.58
	$5g$ $^2D_{2/2}$	259470.16
$3d^8(^3F_2)5g$	$5g$ $^4K_{5/2}$	260590.96
	$5g$ $^2K_{6/2}$	260591.04
	$5g$ $^4H_{3/2}$	260632.62 ?
	$5g$ $^2I_{5/2}$	260646.03 ?
	$5g$ $^4I_{4/2}$	260676.45 ?
	$6s'''$ $^2G_{4/2}$	265292.86 ?
	$5d'''$ $^2I_{5/2}$	265544.10
	$5d'''$ $^2I_{6/2}$	265589.57
	$5d'''$ $^2F_{3/2}$	266079.82
	$5d'''$ $^2F_{2/2}$	266091.84
$3d^8(^1G)6s$	$5d'''$ $^2H_{4/2}$	266597.63
	$5d'''$ $^2H_{5/2}$	266637.30
	$5d'''$ $^2G_{3/2}$	266643.08
	$5d'''$ $^2G_{4/2}$	266653.32
	$5d'''$ $^2D_{2/2}$	267031.05

TABLE 3. Even levels of Cu III—Continued

Configuration	Name	Level (cm <sup>-1</sup> )
$3d^8(^1D)5g$	$5d'''$ $^2D_{1/2}$	267310.38
	$5g'$ $^2H_{5/2}$	273732.91 ?
	$5g'$ $^2H_{4/2}$	273738.68 ?
	$5g'$ $^2I_{5/2}$	273799.53 ?
	$5g'$ $^2G_{3/2}$	273800.58
$3d^8(^1G)5g$	$5g'$ $^2I_{6/2}$	273802.30 ?
	$5g'$ $^2G_{4/2}$	273807.19
	$5g'''$ $^2L_{8/2}$	284095.50
	$5g'''$ $^2L_{7/2}$	284098.12
	$5g'''$ $^2L_{7/2}$	297140
<i>Cu IV</i> $3d^8\ ^3F_4$		

TABLE 4. Odd levels of Cu III

Configuration	Name	Level (cm <sup>-1</sup> )
$3d^8(^3F)4p$	$4p$ $^4D_{3/2}$	118864.85
	$4p$ $^4D_{2/2}$	120577.85
	$4p$ $^4G_{4/2}$	121337.72
	$4p$ $^4G_{5/2}$	121699.08
	$4p$ $^4D_{1/2}$	121864.48
	$4p$ $^4G_{3/2}$	122504.09
	$4p$ $^4D_{1/2}$	122637.26
	$4p$ $^4G_{2/2}$	123440.69
	$4p$ $^4F_{4/2}$	123550.38
	$4p$ $^2G_{4/2}$	124442.77
$3d^8(^3P)4p$	$4p$ $^4F_{3/2}$	124557.85
	$4p$ $^4F_{2/2}$	125382.09
	$4p$ $^4F_{1/2}$	125744.81
	$4p$ $^2G_{3/2}$	126094.14
	$4p$ $^2F_{3/2}$	126829.76
	$4p$ $^2D_{2/2}$	126892.24
	$4p$ $^2D_{1/2}$	128435.61
	$4p$ $^2F_{2/2}$	128679.85
	$4p''$ $^4P_{1/2}$	136483.63
	$4p''$ $^4P_{2/2}$	136607.85
$3d^8(^1D)4p$	$4p''$ $^4P_{1/2}$	137041.60
	$4p'$ $^2F_{2/2}$	138084.98
	$4p'$ $^2F_{3/2}$	138982.86
	$4p'$ $^2D_{1/2}$	138989.01
	$4p'$ $^2P_{1/2}$	139261.52
	$4p'$ $^2D_{2/2}$	139757.46
	$4p'$ $^2P_{1/2}$	140201.72
	$4p''$ $^4D_{2/2}$	142427.10
	$4p''$ $^4D_{1/2}$	142513.20
	$4p''$ $^4D_{1/2}$	142550.75
$3d^8(^3P)4p$	$4p''$ $^4D_{3/2}$	142820.01
	$4p''$ $^2D_{2/2}$	144195.35
	$4p''$ $^2D_{1/2}$	144876.29
	$4p''$ $^2P_{1/2}$	145353.84
	$4p'''$ $^2H_{4/2}$	146534.51
	$4p''$ $^2P_{1/2}$	146675.34
	$4p'''$ $^2H_{5/2}$	147647.87
	$4p''$ $^2S_{1/2}$	147653.36
	$4p''$ $^4S_{1/2}$	147806.69
	$4p'''$ $^2F_{3/2}$	147817.32
$3d^8(^1G)4p$	$4p'''$ $^2F_{2/2}$	148663.85
	$4p'''$ $^2G_{3/2}$	153609.87
	$4p'''$ $^2G_{4/2}$	153808.22
	$4p^{IV}$ $^2P_{1/2}$	182900.11
	$4p^{IV}$ $^2P_{1/2}$	184197.12
	$5p$ $^4D_{3/2}$	211821.00
	$5p$ $^4G_{4/2}$	212415.20
	$5p$ $^4G_{5/2}$	212525.35
	$5p$ $^4F_{4/2}$	212995.16
	$5p$ $^4D_{2/2}$	213025.70

TABLE 4. *Odd levels of Cu III—Continued*

Configuration	Name	Level (cm <sup>-1</sup> )
$3d^8(^3F_3)5p$	$5p\ ^4F_{3/2}$	213311.78
	$5p\ ^4G_{3/2}$	214328.03
	$5p\ ^4D_{1/2}$	214357.95
	$5p\ ^2G_{4/2}$	214588.27
	$5p\ ^2D_{2/2}$	214702.78
$3d^8(^3F_2)5p$	$5p\ ^4F_{2/2}$	214766.34
	$5p\ ^2F_{3/2}$	215000.50
	$5p\ ^4D_{1/2}$	215160.74
	$5p\ ^4G_{2/2}$	215417.25
	$5p\ ^4F_{1/2}$	215782.96
	$5p\ ^2G_{3/2}$	216017.68
	$5p\ ^2D_{1/2}$	216448.63
	$5p\ ^2F_{2/2}$	216565.74
	$z\ ^4F_{4/2}$	223134.65
	$z\ ^4G_{5/2}$	223229.90
$3d^7(^4F)sp(^3P)$	$z\ ^4F_{3/2}$	223570.61
	$z\ ^4G_{4/2}$	224048.02
	$z\ ^4F_{2/2}$	224450.45
	$z\ ^4F_{1/2}$	225235.39
	$z\ ^4D_{3/2}$	225923.90
	$z\ ^4D_{2/2}$	226857.54
	$z\ ^4D_{1/2}$	227494.85
	$z\ ^4D_{1/2}$	227964.02 ?
	$5p'\ ^2D_{2/2}$	228423.50
	$5p'\ ^2D_{1/2}$	228468.86
	$5p'\ ^2F_{2/2}$	228960.05
	$5p'\ ^2P_{1/2}$	229054.02
	$5p'\ ^2F_{3/2}$	229098.47
$3d^8(^3P)5p$	$5p''\ ^2P_{1/2}$	229505.30
	$5p''\ ^4P_{1/2}$	231298.41 ?
	$5p''\ ^4P_{2/2}$	231333.00
	$5p''\ ^4P_{1/2}$	231457.50
	$5p''\ ^4D_{3/2}$	232435.96
	$5p''\ ^4D_{2/2}$	232458.10
	$5p''\ ^4D_{1/2}$	232478.23 ?
	$5p''\ ^2P_{1/2}$	232814.29
	$z\ ^2D_{2/2}$	232989.62 ?
	$5p''\ ^2D_{2/2}$	233285.96
$3d^8(^3F_4)4f$	$5p''\ ^2D_{1/2}$	233653.51
	$5p''\ ^4S_{1/2}$	234036.16
	$4f\ ^4S_{1/2}$	234427.01
	$4f\ ^4P_{2/2}$	234490.73
	$4f\ ^2S_{1/2}$	234530.60
	$4f\ ^4I_{6/2}$	234532.91
	$4f\ ^4I_{7/2}$	234537.43
	$4f\ ^4D_{3/2}$	234562.13
	$z\ ^2D_{1/2}$	234650.41 ?
	$4f\ ^4F_{4/2}$	234654.68
$3d^7(^4F)sp(^3P)$ $3d^8(^3F_4)4f$	$4f\ ^4P_{1/2}$	234660.53
	$4f\ ^4H_{6/2}$	234670.98
	$4f\ ^4H_{5/2}$	234681.35
	$4f\ ^4G_{5/2}$	234716.80
	$4f\ ^4G_{4/2}$	234774.74
	$4f\ ^4D_{2/2}$	234775.00
	$4f\ ^4F_{3/2}$	234812.88
	$4f\ ^4P_{1/2}$	236323.71
	$4f\ ^4D_{1/2}$	236370.88
	$4f\ ^2P_{1/2}$	236395.02
$3d^8(^3F_3)4f$	$4f\ ^2I_{6/2}$	236417.68
	$4f\ ^4I_{5/2}$	236418.68
	$4f\ ^4F_{2/2}$	236471.28
	$4f\ ^4D_{1/2}$	236484.91
	$4f\ ^4F_{3/2}$	236511.51
	$4f\ ^2H_{5/2}$	236531.91
	$4f\ ^2G_{4/2}$	236537.18
	$4f\ ^4H_{4/2}$	236550.40
	$4f\ ^2D_{2/2}$	236590.41
	$4f\ ^4G_{3/2}$	236611.48
$3d^8(^3F_2)4f$	$4f\ ^4F_{1/2}$	237538.57
	$4f\ ^2P_{1/2}$	237591.35
	$4f\ ^2I_{5/2}$	237641.05

TABLE 4. *Odd levels of Cu III—Continued*

Configuration	Name	Level (cm <sup>-1</sup> )
$3d^8(^1G)5p$	$4f\ ^4I_{4/2}$	237644.52
	$4f\ ^2F_{2/2}$	237674.38
	$4f\ ^2D_{1/2}$	237734.00
	$4f\ ^2G_{3/2}$	237751.21
	$4f\ ^2H_{4/2}$	237778.99
	$4f\ ^4H_{3/2}$	237814.57
	$4f\ ^4G_{2/2}$	237830.63
	$5p'''\ ^2H_{4/2}$	238788.16
	$5p'''\ ^2F_{3/2}$	238833.78
	$5p'''\ ^2H_{5/2}$	239142.42
$3d^7(^2G)sp(^3P)$ $3d^8(^1G)5p$	$5p'''\ ^2F_{2/2}$	239148.82
	$y\ ^4F_{4/2}$	239606.85
	$5p'''\ ^2G_{3/2}$	240786.48
	$5p'''\ ^2G_{4/2}$	240852.75
	$w\ ^4D_{3/2}$	243234.10
	$w\ ^4D_{2/2}$	244602.61
	$w\ ^4G_{5/2}$	245139.94
	$v\ ^4D_{3/2}$	245671.35
	$1^{\circ}\ ^4I_{4/2}$	246202.65
	$w\ ^4G_{4/2}$	246439.20
$3d^7(^2H)sp(^3P)$ $3d^7(^2D)sp(^3P)$ $3d^7sp$ $3d^7(^2H)sp(^3P)$ $3d^7(^2D)sp(^3P)$	$w\ ^4F_{4/2}$	246510.54
	$w\ ^4F_{3/2}$	247475.26
	$x\ ^4G_{5/2}$	247578.66
	$x\ ^4F_{4/2}$	247902.05
	$2^{\circ}\ ^4I_{4/2}$	247924.26
	$3^{\circ}\ ^3I_{3/2}$	248013.84
	$w\ ^4F_{2/2}$	248281.96
	$4^{\circ}\ ^4I_{4/2}$	248360.45
	$w\ ^4F_{1/2}$	248896.92
	$x\ ^4G_{4/2}$	249077.07
$3d^7(^4F)sp(^1P)$ $3d^7sp$ $3d^7(^4F)sp(^1P)$	$5^{\circ}\ ^5P_{1/2}$	249353.93
	$6^{\circ}\ ^6I_{2/2}$	249421.55
	$x\ ^4G_{3/2}$	250168.06
	$x\ ^4D_{3/2}$	250419.48
	$x\ ^4F_{3/2}$	250636.95
	$4f'\ ^2F_{2/2}$	250731.98
	$4f'\ ^2G_{3/2}$	250733.55
	$4f'\ ^2G_{4/2}$	250734.45
	$4f'\ ^2F_{3/2}$	250817.68
	$4f'\ ^2H_{2/2}$	250955.22 ?
$3d^7(^4F)sp(^1P)$ $3d^8(^3P)4f$	$4f'\ ^2H_{4/2}$	250999.71
	$4f'\ ^2H_{5/2}$	251010.62
	$x\ ^4G_{2/2}$	251052.76 ?
	$x\ ^4D_{2/2}$	251932.36
	$x\ ^4F_{2/2}$	252437.63
	$x\ ^4D_{1/2}$	253102.60
	$x\ ^4D_{1/2}$	253713.29 ?
	$4f'''\ ^4F_{4/2}$	254030.84
	$4f'''\ ^4F_{2/2}$	254125.74
	$4f'''\ ^2F_{3/2}$	254132.14
$3d^7(^4F)sp(^1P)$ $3d^8(^3P)4f$	$x\ ^4F_{1/2}$	254147.19 ?
	$4f'''\ ^2G_{4/2}$	254448.81
	$4f'''\ ^4G_{5/2}$	254467.96
	$4f'''\ ^4D_{1/2}$	254673.30 ?
	$4f'''\ ^4G_{3/2}$	254772.26
	$4f'''\ ^4G_{4/2}$	254784.41
	$4f'''\ ^4D_{2/2}$	254794.45
	$4f'''\ ^4D_{3/2}$	254926.68
	$4f''''\ ^2K_{7/2}$	261167.97
	$4f''''\ ^2K_{6/2}$	261169.55
$ed^8(^1G)4f$	$4f''''\ ^2F_{3/2}$	261563.41
	$4f''''\ ^2G_{4/2}$	261757.14
	$4f''''\ ^2G_{3/2}$	261762.79
	$4f''''\ ^2I_{6/2}$	261812.11
	$4f''''\ ^2I_{5/2}$	261820.32
	$4f''''\ ^2H_{4/2}$	261995.84
	$4f''''\ ^2H_{5/2}$	261998.41
	$4f''''\ ^2H_{5/2}$	297140
Cu IV $3d^8\ ^3F_4$		

The numerical differences between observed and calculated levels are quite definite. Differences between the names assigned by the two methods are fairly frequent, and are of course based on less definite evidence. In particular, in the  $4d$  groups of levels, there are 17 cases of differing names. This is partly due to the presence of the  $s^2H$  term and the thorough way in which it is embedded amongst the  $4d$  levels. In no case, however, in any of the various structures is there as extreme a disagreement as is described in [2, Addenda] for the case of  $4p^4G_{41/2}$ ,  $4p^4F_{41/2}$ ,  $4p^2G_{41/2}$  in Ni II.

After much of the analysis was done, there were many unidentified lines in the short wavelength end of the spectrum. On examination, I found that most of them could be paired off by differences between  $4s^4F$  and  $4s^2^4F$ . Since they had to be due to levels of  $3d^74s4p$ , I plotted them on a graph with the levels of Co I and Ni II and was able to identify the origin of the majority of them. They appear in the term table with the same names as the corresponding levels in Ni II [2]. There are six numbered levels which could not be included amongst those identified.

#### 4. Ionization Potential

The most important and reliable series from which to calculate a limit is the series  $ns^4F_{41/2}$  in which there are three members quite accurately determined and a fourth which is undependable. A Ritz calculation of  $4s$ ,  $5s$ ,  $6s^4F_{41/2}$  yields a limit  $296980 \text{ cm}^{-1}$ , the formula being  $n^* = n + \mu - \alpha T'$  where  $T' = \frac{T}{9}$ ,  $\mu = 0.12070$ , and  $\alpha = 2.886 \times 10^{-6}$ . When the series  $ns'^2D_{21/2}$ ,  $ns''^4P_{21/2}$  and  $ns'''^2G_{41/2}$  each of three terms are fitted to Ritz formulae without reference to the analysis of Cu IV [7] they yield the following results:

Series	Limit	Limit above $^3F_4$	Limit level in Cu IV [6]	Diff.
$ns^4F_{41/2}$	296980	00.	00	00
$ns'^2D_{21/2}$	313198	16213.	16249	+36
$ns''^4P_{21/2}$	316622	19642.	19696	+54
$ns'''^2G_{41/2}$	323881 ?	26901	27074	+173

The values of the limits of the  $^2D$  and  $^4P$  series cannot be much in error, but there is some doubt about the  $^2G$  because the  $6s'''^2G$  term is not well established. It is, however, close to the calculated value.

The comparison of the four series listed above is legitimate because they are all calculated from  $4s$ ,  $5s$ , and  $6s$  levels. It is known of course that, if higher series levels are found, it is possible to derive a more probable value of the true limit. In Ni II, where the series is known up to  $9s$ , the limit from (4, 5, 6s) is  $146462 \text{ cm}^{-1}$ , from (5, 6, 7s) it is  $146521 \text{ cm}^{-1}$ , and from (6, 7, 8, 9s) it is  $146532 \text{ cm}^{-1}$ . The Ni II limit obtained from the  $ng^4K_{81/2}$  series, which should be close to

the true limit, is  $146541 \text{ cm}^{-1}$ . If those four values are plotted, they appear to form a curve converging towards the last one at very large values of  $n$ . If we accept the limit of  $146541 \text{ cm}^{-1}$  as being very near the true value and assume that the same relative increase can be applied to Cu III, we can calculate as a probable true ionization potential the value  $296980 \text{ cm}^{-1} \times 1.00054 = 297140 \text{ cm}^{-1}$ .

#### 5. Analysis of Cu IV

I regret very much that it is incumbent upon me to criticize the paper on Cu IV published in 1970 by J. F. Schröder and Th. A. M. Van Kleef [7]. My criticism is known to Dr. Van Kleef, with whom I have had a considerable correspondence on the subject.

The sources used to excite the spectra in that paper and in this were very similar and the observed spectra were obviously also very similar. Apparently the Cu IV measurement of the lines used fewer good standards than I did for the Cu III spectra, in which I found many Cu II, Si II, C I and Cl I lines given to  $10^{-4} \text{ Å}$ . The resulting wavelengths differ so much that it would, in many cases, be difficult to identify the same line in the two spectra if it were not for the fact that all the lines of any intensity appear in both spectra. A wavelength difference may be as high as  $0.03 \text{ Å}$ , but the identity cannot be questioned. It is very odd also that there are about 140 weak lines which I do not observe at all, in spite of immense over-exposure of the strong lines.

My criticism of the Cu IV paper is based on the following facts.

(1) There are nine lines of Cu II included in the analysis and a tenth, the strongest line of Cu II in the Schumann region,  $1358.773 \text{ Å}$ , which appears as two strong lines due to reversal. The lines are as follows.

Cu II lines	
$\lambda$ [7]	$\lambda$ [3]
2161.995	0.999
2130.763	.758
2085.983	.938 and 973 (AGS)
1929.757	.752
1522.587	.577
1517.918	.930
1472.421	.395
1358.770	.773
1358.732	
1044.748	.744
1039.589	.582

The two lines at  $2085 \text{ Å}$  are both Cu II, observed in the direct current hollow cathode tube. The two lines at  $1358 \text{ Å}$  are the two sides of the most heavily reversed line in the Cu II spectrum,  $3d^{10}^1S_0 - 3d^94p^1P_1$ . The line at  $1472 \text{ Å}$  is the companion line  $3d^{10}^1S_0 - 3d^94p^3P_1$ .



(2) There are five impurity lines.

$\lambda$ [7]		
1602.960	0.972 C I	[4]
1467.423	.402 C I	[4]
1280.353	.333 C I	[4]
1261.132	.122 C I	[4]
580.970	.967 O II	[9]

(3) Nine second order lines are included.

$\lambda$ [7]	$\lambda$ (AGS)	Origin	
1576.895	$788.460 \times 2 = 1576.920$	Cu III	
1404.247	$702.118 \times 2 = 1404.236$	Cu III	
1400.527	$700.261 \times 2 = 1400.522$	Cu III	
1373.812	$686.902 \times 2 = 1373.804$	Cu III	
1301.999	$651.000 \times 2 = 1302.000$	Cu III	
1216.910	$608.453 \times 2 = 1216.906$	Cu III	
1165.308	$582.657 \times 2 = 1165.314$	Cu III	
1098.151	$549.075 \times 2 = 1098.150$	Cu III	
1051.588	$525.795 \times 2 = 1051.590$	O III [9]	

(4) Other questionable lines

1654.655	1654.559	Cu III	
1549.288	1549.215	Cu III and 0.306	Cu III?
1348.880	1348.831	Cu III and 0.919	Cu IV
1312.948	Obs-Calc is 13.4 not 0.4 $\text{cm}^{-1}$		
1245.691	1245.643 ?	and 0.724 both	Cu III
1240.160	1240.126 and 0.216 both	Cu III	

(5) Cu III lines used as Cu IV

There are 69 lines in table 1 of this paper which are identified as Cu IV in [7] but which, on my evidence, belong to Cu III. They have been examined individually with great care in all available exposures. It is possible that a few of the lines in my list may be partly IV and partly III, but it can only be a very small number.

In the course of examining the question of the origin of lines, I made a complete square array of the Cu IV analysis. On that diagram I marked all the questionable lines and it then appeared that a considerable number of levels must be spurious. To be certain of the whole analysis, it would be necessary to make a completely new and more accurate description of the spectrum, but from the diagram some examples can be given. The  $^5P_3$  at 139604 may be correct, but its accompanying  $^5P_2$  and  $^5P_1$  are based on many lines included in my various categories above. The deletion of those 2

levels destroys the  $^5S^{\circ}_2$  at 204149 and all of the  $^5D^{\circ}$  at 214225 except  $^5D^{\circ}_4$ .

As a second example, the  $^3G_5$  at 140070 is probably correct, but  $^3G_4$  and  $^3G_3$  must be spurious and they, in turn, make many of the odd levels based on the  $^2G$  term of Cu V very doubtful, indeed. A very dubious level is the  $^1G$  at 148885 which includes four Cu III lines among its few combinations. The two even  $^3P$  terms are both dubious and they lead to doubt about the odd terms based on the same ion terms. The highest  $^3D$  term includes four Cu III lines amongst its rather few combinations.

From all the evidence I can only conclude that the Cu IV spectrum should be re-examined in its entirety.

## 6. Conclusion

In spite of the fact that the analysis of Cu III presented in this paper has been worked on for so many years, it is obviously incomplete and it is disappointing that some lines of considerable strength remain unclassified. Perhaps it is inherent in the kind of source that one must use to excite spectra above the second that it suppresses the less probable transitions and makes high levels very difficult to find. As an example, one can contrast the many transitions of the  $ng$  levels in Ni II with the great paucity of such transitions in Cu III. If it becomes possible to devise sources which overcome such difficulties, Cu III will have to be more completely observed and analysed by someone else, not me, and this paper will then serve as a useful guide.

## 7. References

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